

4 后悬架建模 .....	108
4.1 创建上后连杆.....	108
4.1.1 创建硬点.....	108
4.1.2 创建上后连杆的 PART.....	108
4.1.3 创建上后连杆 part 的几何体.....	109
4.2 创建上前控制臂.....	110
4.2.1 创建上前控制臂硬点.....	110
4.2.2 建立 Part 上前控制臂.....	111
4.2.3 创建上前控制臂几何体.....	112
4.3 创建下控制臂.....	112
4.3.1 建立下控制臂硬点.....	112
4.3.2 建立下控制臂 PART.....	113
4.3.3 建立下控制臂几何体 Link.....	114
4.4 创建后副车架.....	115
4.4.1 建立后副车架中心 Frame.....	115
4.4.2 建立后副车架硬点.....	117
4.4.3 建立后副车架 Part.....	117
4.4.4 建立后副车架的 Outline.....	118
4.6 创建下控制臂和转向节之间的小连接板.....	119
4.6.1 建立小连接板上球铰点.....	119
4.6.2 建立小连接板下球铰点.....	120
4.6.3 建小连接板 Part.....	120
4.6.4 建立小连接板的几何体 Link.....	121
4.7 创建转向节.....	122
4.7.1 建立转向节中心点.....	122
4.7.2 建立转向节的 Part.....	122
4.7.3 建立转向节的 Link.....	123
4.8 建立轮毂 .....	125
4.8.1 建立轮心点坐标.....	125
4.8.2 建立轮毂 part.....	126
4.8.3 建立轮毂的几何体 Link.....	127
4.9 创建弹簧 .....	127
4.9.1 建立弹簧上安装点.....	127
4.9.2 建立弹簧下安装点.....	127
4.9.3 创建弹簧.....	128
4.9.4 建立连接转向节和弹簧间的 Link.....	129
4.9.5 建立后减振器与车身间的 Mount part.....	129
4.10 创建驱动轴半轴.....	130
4.10.1 建立半轴内点.....	130
4.10.2 建立半轴外点及相应的 Construction Frame.....	130
4.10.3 建立驱动轴的 Part.....	131
4.10.4 建立驱动轴的 Link.....	132
4.10.5 建立 Tripot 的 Part.....	133
4.10.6 建立驱动轴内点处的 Construction Frame.....	134

4.10.7 建立 Tripot 的几何体.....	135
4.11 建立球笼到后差速器的 Mount part.....	136
4.12 建立后悬架的前束和外倾角参数变量.....	136
4.13 建立轮心的 Construction Frame.....	138
4.14 创建减振器.....	138
4.14.1 建立减振器硬点.....	138
4.14.2 建立减振器上下两部分 part.....	139
4.14.3 建立减振器阻尼力.....	140
4.14.4 创建减振器上下限位块.....	141
4.15 创建部件间的衬套连接.....	145
4.15.1 创建下控制臂与副车架连接衬套.....	145
4.15.2 创建上连杆与副车架连接衬套.....	147
4.15.3 创建小连接板连接衬套.....	149
4.15.4 建立减振器下端的 Bush.....	151
4.15.5 建立减振器上端上 Top Mount.....	152
4.15.6 创建后副车架到车身的衬套.....	153
4.16 创建部件间的刚性连接.....	156
4.17 设定悬架参数.....	168
4.18 创建必要的输出通讯器.....	169
4.19 保存模型.....	170

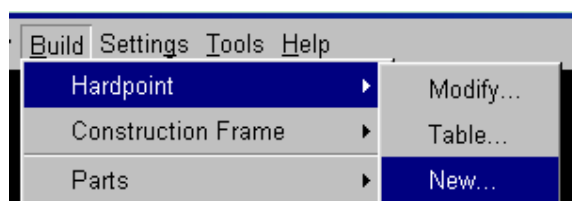
# 《后悬架篇》

## 4 后悬架建模

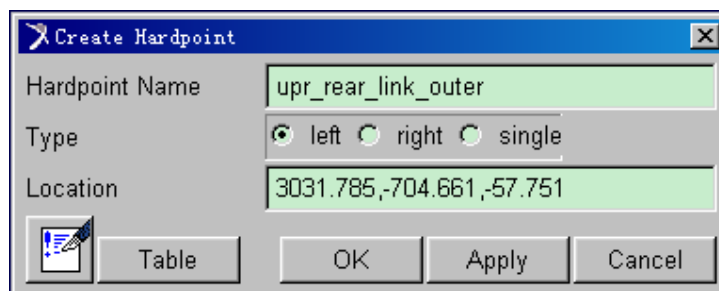
### 4.1 创建上后连杆

#### 4.1.1 创建硬点

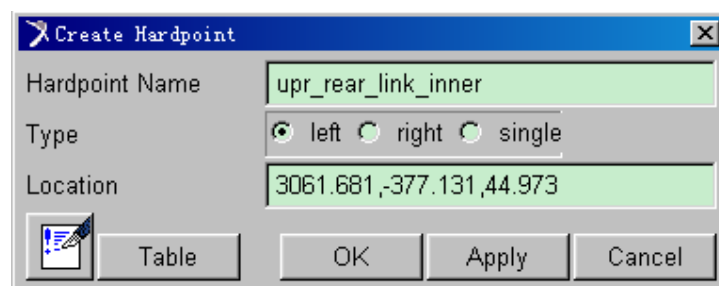
从下拉菜单选择 Build>Hardpoint>New。



在对话框里输入以下内容：



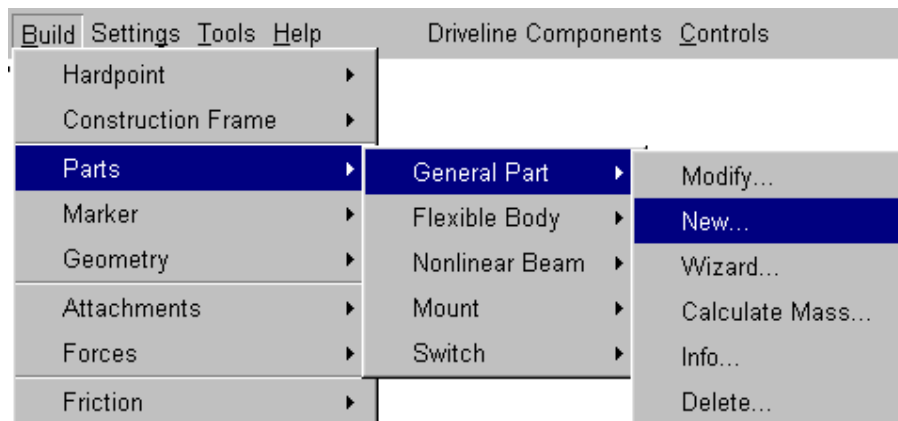
点击 Apply，修改对话框内容如下：



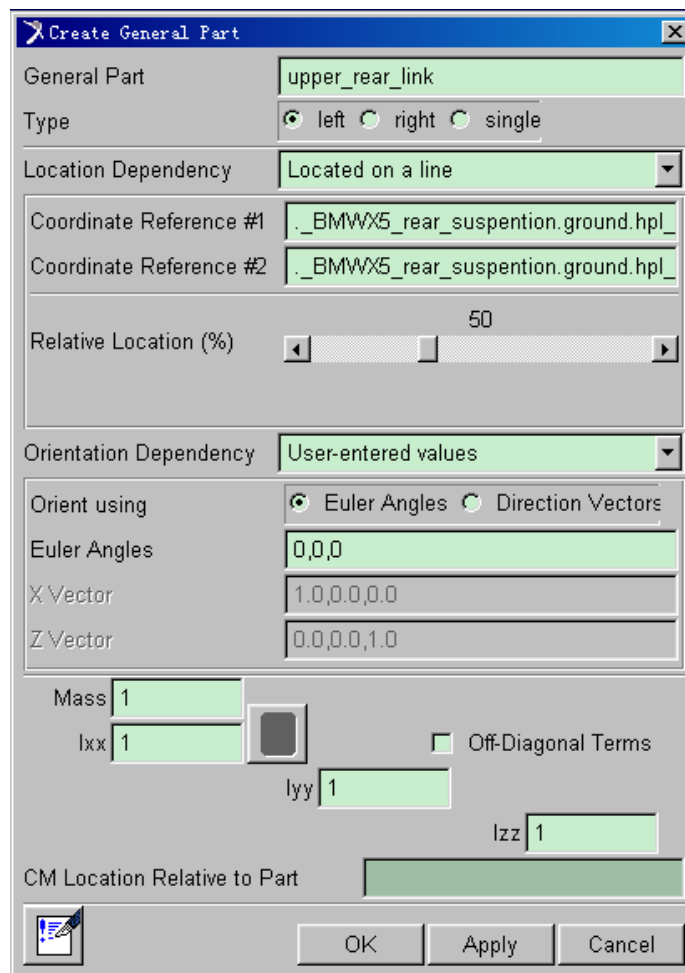
点击 OK。

#### 4.1.2 创建上后连杆的 PART

从菜单选择 Build>Parts>General Parts>New。



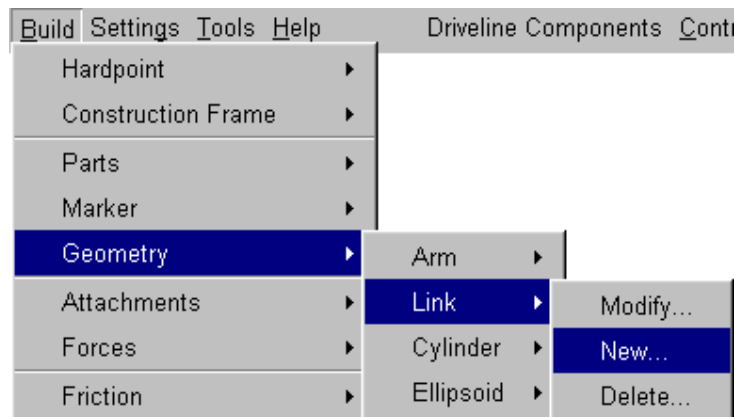
在出现的对话框里输入如下内容:



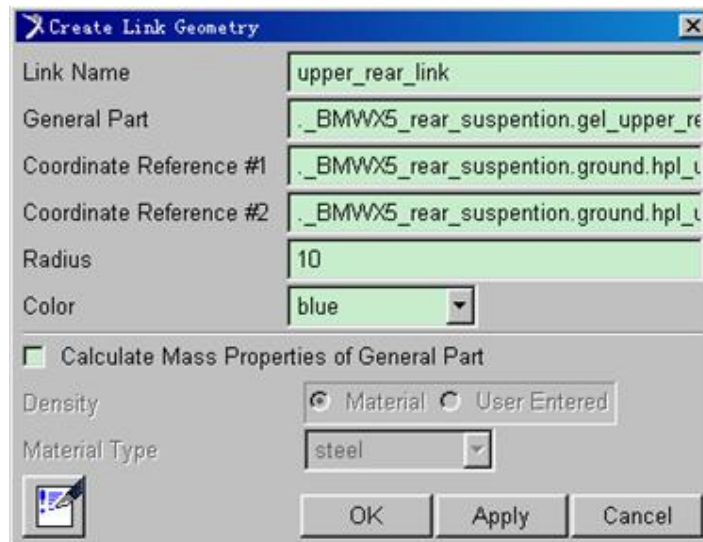
点击 OK。

#### 4.1.3 创建上后连杆 part 的几何体

从菜单选择 Build>Geometry>Link>New。



在出现的对话框里输入以下内容:



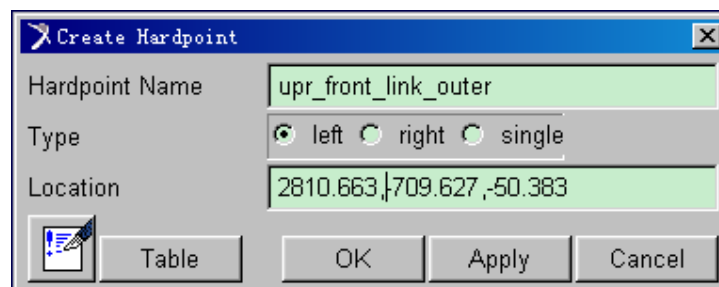
点击 OK。

## 4.2 创建上前控制臂

### 4.2.1 创建上前控制臂硬点

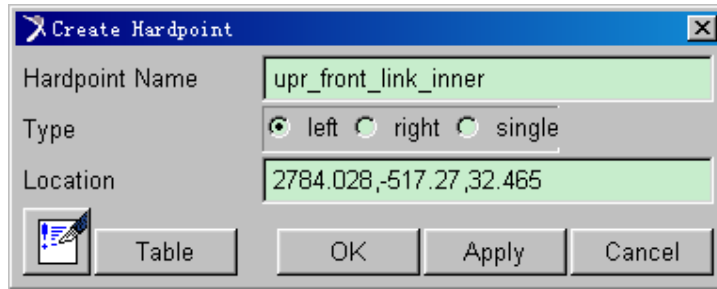
#### 1) 上前控制臂外点

从下拉菜单选择 Build>Hardpoint>New, 对话框设置如下:



点击 Apply。

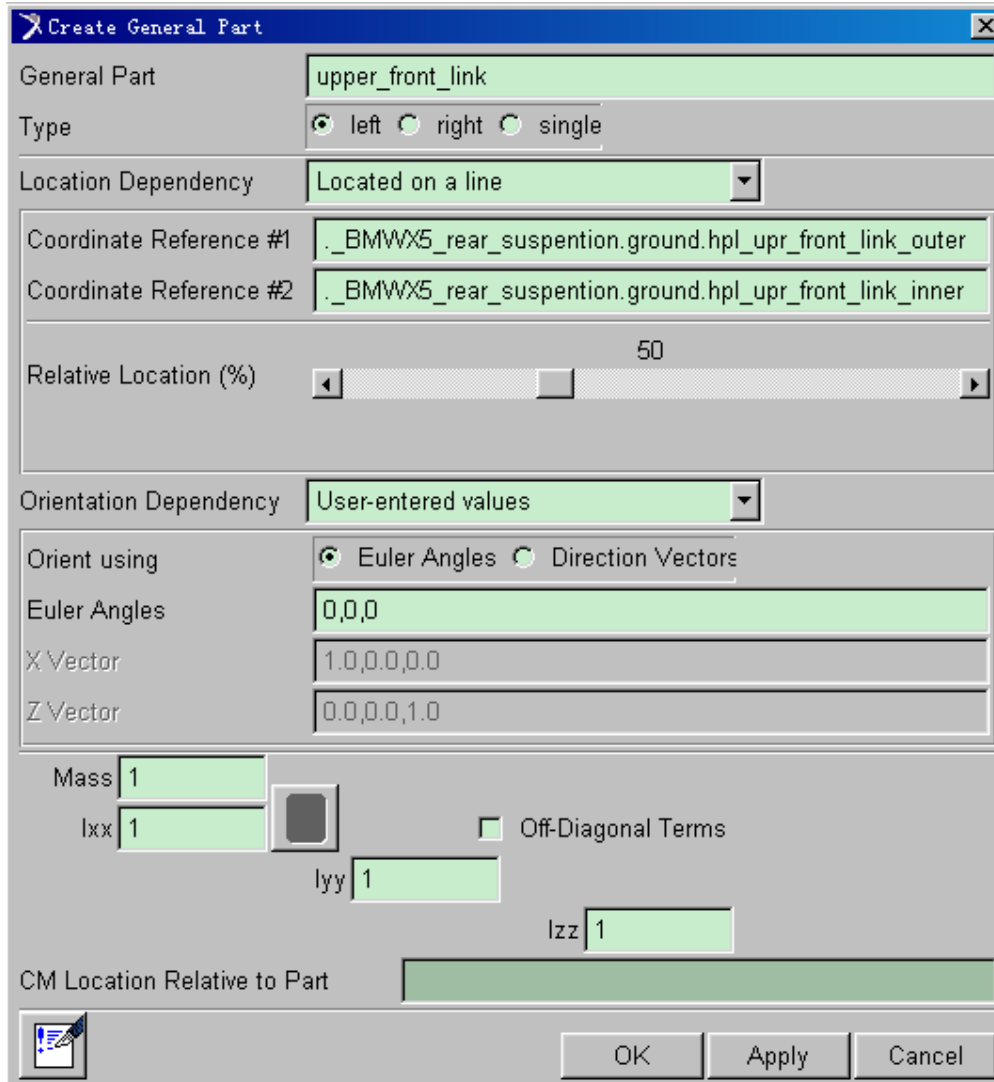
2) 上前控制臂内点  
修改对话框内容如下:



点击 OK。

#### 4.2.2 建立 Part 上前控制臂

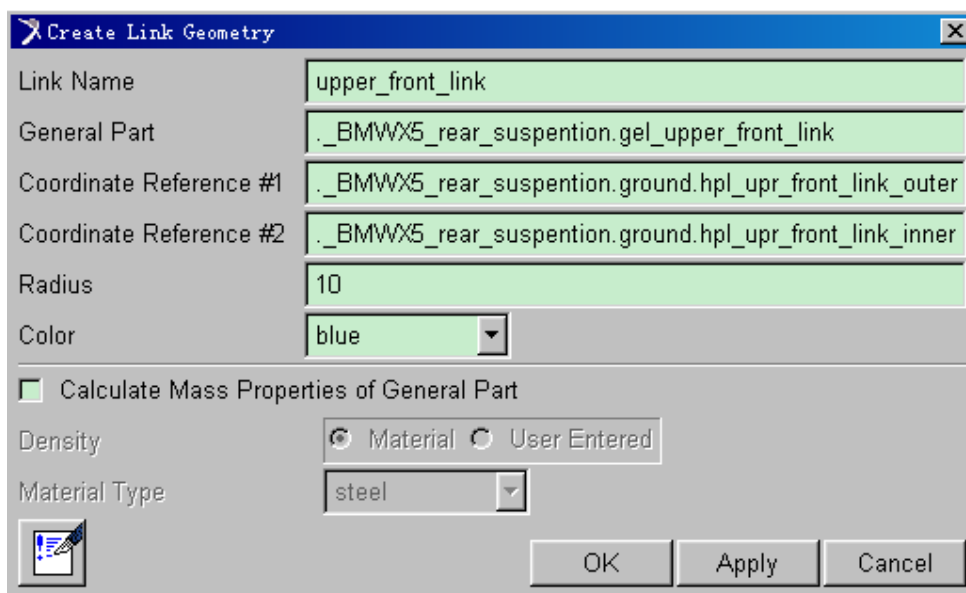
从菜单选择 Build>Parts>General Part>New, 在出现的对话框里输入以下内容:



点击 OK。

### 4.2.3 创建上前控制臂几何体

从菜单选择 Build>Geometry>Link>New, 设置对话框内容如下:



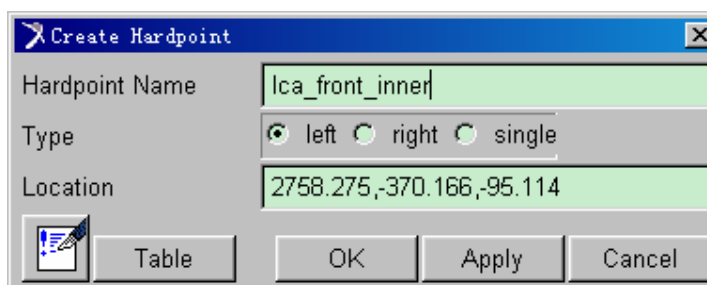
点击 OK。

## 4.3 创建下控制臂

### 4.3.1 建立下控制臂硬点

1) 下控制臂前内点

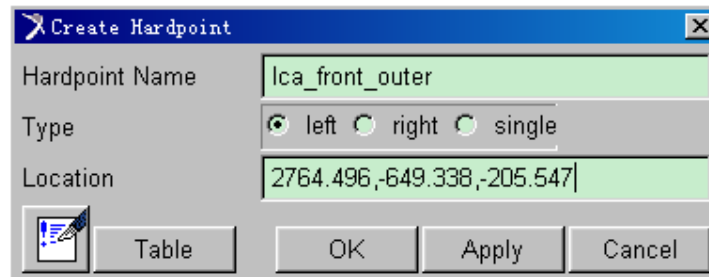
从下拉菜单选择 Build>Hardpoint>New, 设置对话框内容如下:



点击 Apply。

2) 建立下控制臂前外点

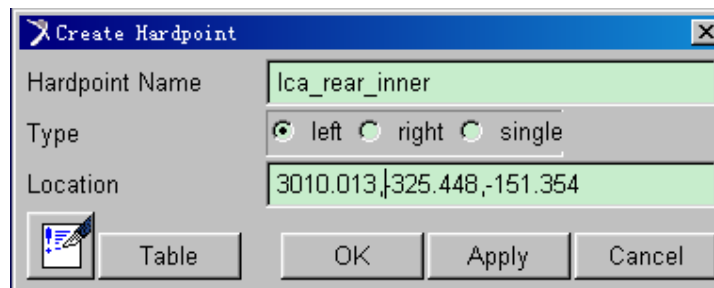
修改上面的对话框内容:



点击 Apply。

3) 建立下控制臂后内点

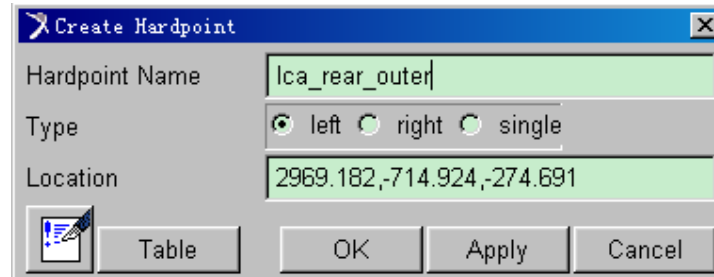
修改上面的对话框内容:



点击 Apply。

4) 建立下控制臂后外点

修改上面的对话框内容:



点击 OK。

#### 4.3.2 建立下控制臂 PART

从菜单选择 Build>Parts>General Part>New, 在出现的对话框里输入以下内容:



**Create General Part**

General Part:

Type: ☒ left ☐ right ☐ single

Location Dependency:

Centered between:

Coordinate Reference #1:

Coordinate Reference #2:

Coordinate Reference #3:

Coordinate Reference #4:

Orientation Dependency:

Orient using: ☒ Euler Angles ☐ Direction Vectors

Euler Angles:

X Vector:

Z Vector:


Mass:

Ixx:  ☐ Off-Diagonal Terms

Iyy:

Izz:

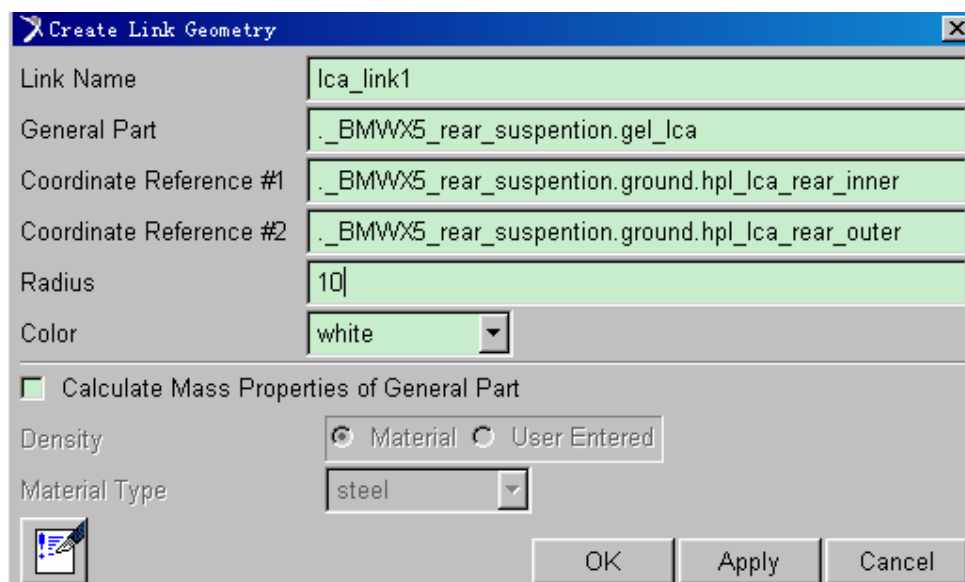
CM Location Relative to Part:



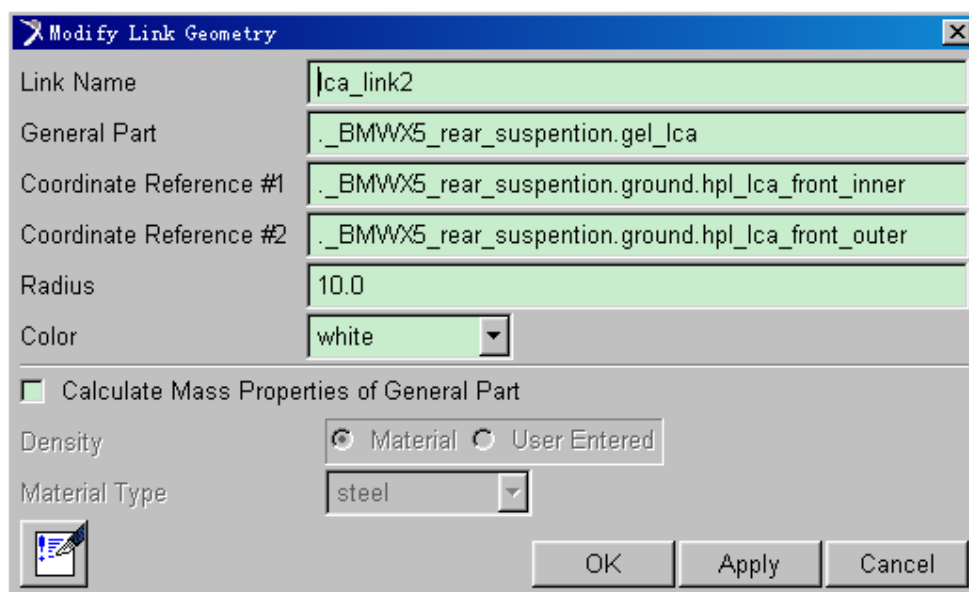
点击 OK。

#### 4.3.3 建立下控制臂几何体 link

从菜单选择 Build>Geometry>Link>New，设置对话框内容如下：



点击 Apply，修改上面对话框内容如下：

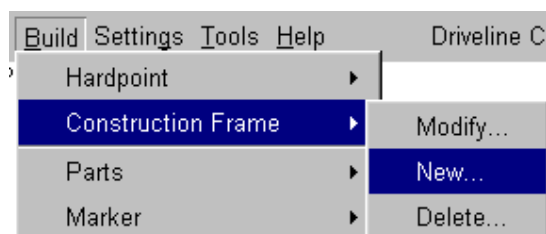


点击 OK。

## 4.4 创建后副车架

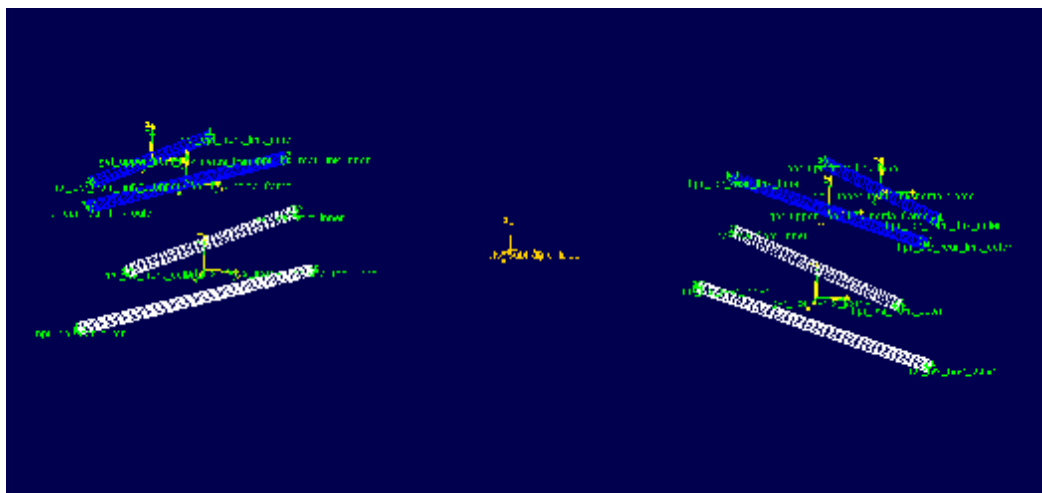
### 4.4.1 建立后副车架中心 Frame

从菜单选择 Build>Construction Frame>New。



在出现的对话框里输入以下内容：

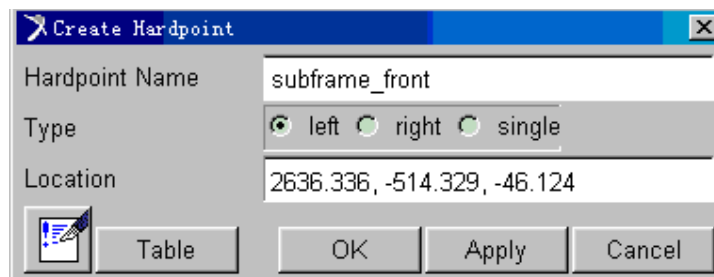
点击 OK。创建的杆系如下图所示：



#### 4.4.2 建立后副车架硬点

##### 1) 前安装点

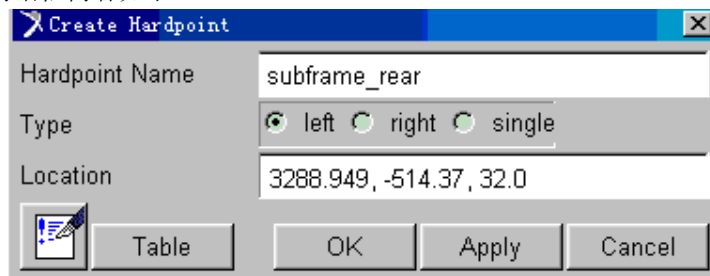
从菜单选择 Build>Hard Points>New, 在对话框里输入以下内容:



点击 Apply。

##### 2) 后安装点

修改上面对话框内容如下:



点击 OK。

#### 4.4.3 建立后副车架 Part

从菜单选择 Build>Parts>General Part>New, 在出现的对话框里输入以下内容:

**Create General Part**

General Part:

Type: ☐ left ☐ right ☒ single

Location Dependency:

Centered between:

Coordinate Reference #1:

Coordinate Reference #2:

Coordinate Reference #3:

Coordinate Reference #4:

Orientation Dependency:

Orient using: ☒ Euler Angles ☐ Direction Vectors

Euler Angles:

X Vector:

Z Vector:


Mass:

Ixx:  ☐ Off-Diagonal Terms

Iyy:

Izz:

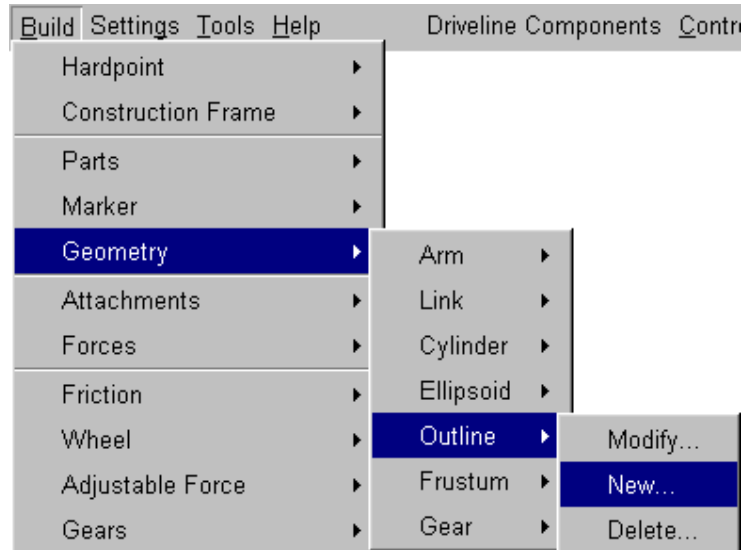
CM Location Relative to Part:



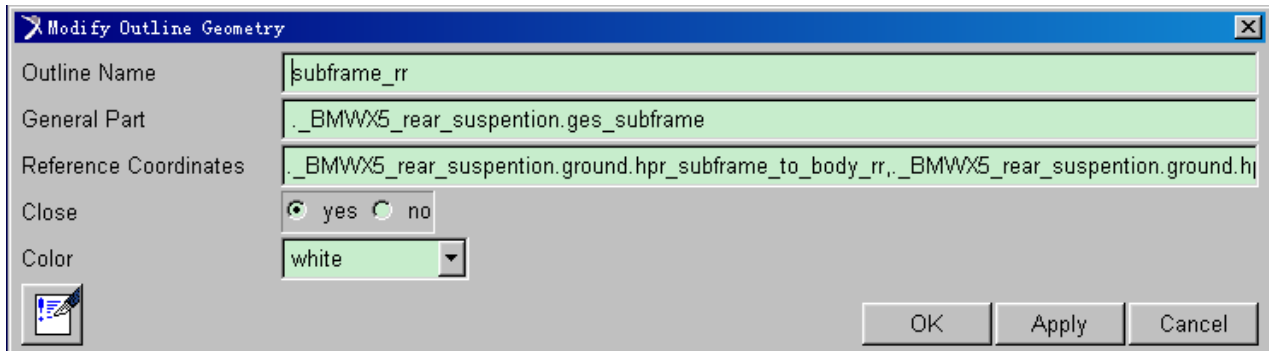
点击 OK。

#### 4.4.4 建立后副车架的 Outline

从菜单选择 Build>Geometry>Outline>New。



在出现的对话框里输入以下内容:

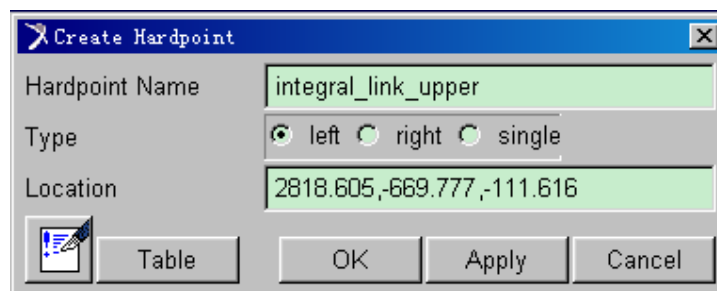


点击 OK。

## 4.6 创建下控制臂和转向节之间的小连接板

### 4.6.1 建立小连接板上球铰点

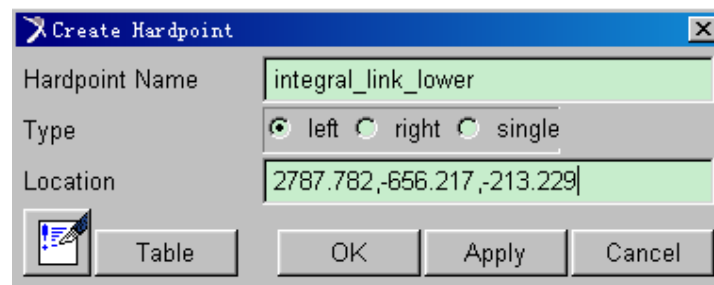
从菜单选择 Build>Geometry>Outline>New。



点击 Apply。

#### 4.6.2 建立小连接板下球铰点

修改对话框内容如下:



点击 OK。

#### 4.6.3 建小连接板 Part

从菜单选择 Build>Parts>General Part>New, 在出现的对话框里输入以下内容:

**Create General Part**

General Part:

Type: ☒ left ☐ right ☐ single

Location Dependency:

Centered between:

Coordinate Reference #1:

Coordinate Reference #2:

Coordinate Reference #3:

Coordinate Reference #4:

Orientation Dependency:

Orient using: ☒ Euler Angles ☐ Direction Vectors

Euler Angles:

X Vector:

Z Vector:


Mass:

Ixx:  ☐ Off-Diagonal Terms

Iyy:

Izz:

CM Location Relative to Part:

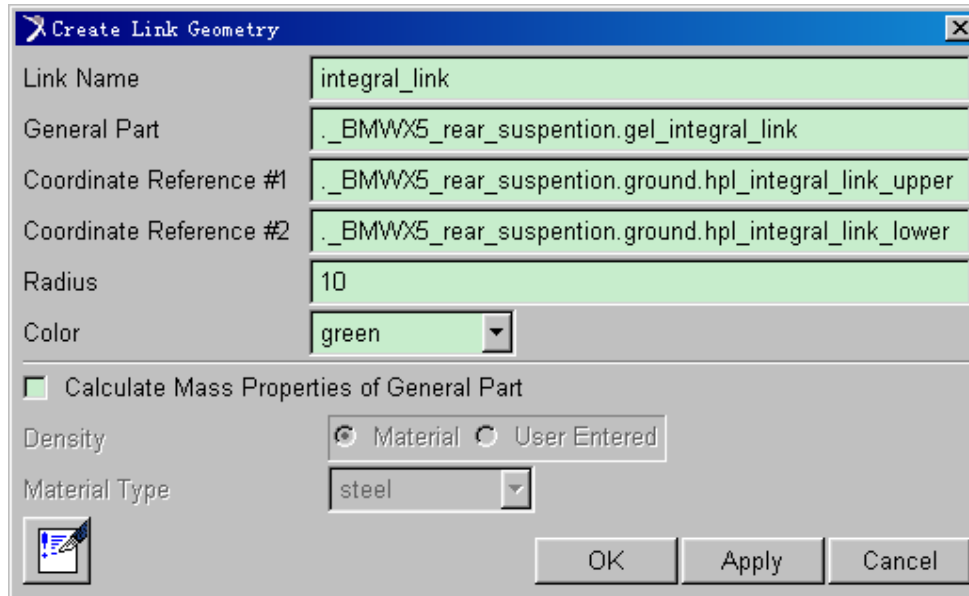


点击 OK。

#### 4.6.4 建立小连接板的几何体 Link

从菜单选择 Build>Geometry>Link>New，设置对话框内容如下：



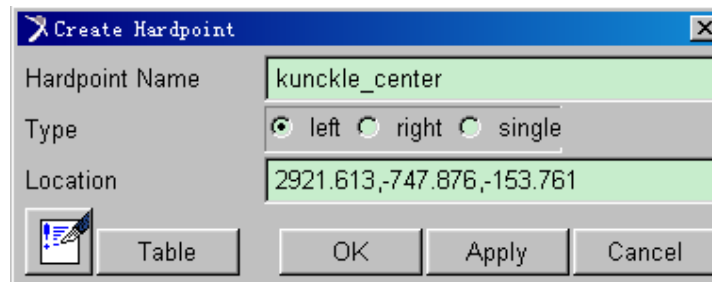


点击 OK。

## 4.7 创建转向节

### 4.7.1 建立转向节中心点

从下拉菜单选择 Build>Hardpoint>New，设置对话框内容如下：



点击 OK。

### 4.7.2 建立转向节的 Part

从菜单选择 Build>Parts>General Part>New，在出现的对话框里输入以下内容：

**Create General Part**

General Part:

Type: ☒ left ☐ right ☐ single

Location Dependency:

Coordinate Reference:

Location:

Location in: ☒ local ☐ globa

Orientation Dependency:

Orient using: ☒ Euler Angles ☐ Direction Vectors

Euler Angles:

X Vector:

Z Vector:


Mass:

Ixx:  ☐ Off-Diagonal Terms

Iyy:

Izz:

CM Location Relative to Part:




点击 OK。

#### 4.7.3 建立转向节的 Link

从菜单选择 Build>Geometry>Link>New，设置对话框内容如下：

**Create Link Geometry**


Link Name	kunckle_link1
General Part	._BMW5_rear_suspention.gel_kunckle_rr
Coordinate Reference #1	._BMW5_rear_suspention.ground.hpl_integral_link_upper
Coordinate Reference #2	._BMW5_rear_suspention.ground.hpl_kunckle_center
Radius	10
Color	red
<input type="checkbox"/> Calculate Mass Properties of General Part	
Density	<input checked="" type="radio"/> Material <input type="radio"/> User Entered
Material Type	steel

 OK Apply Cancel

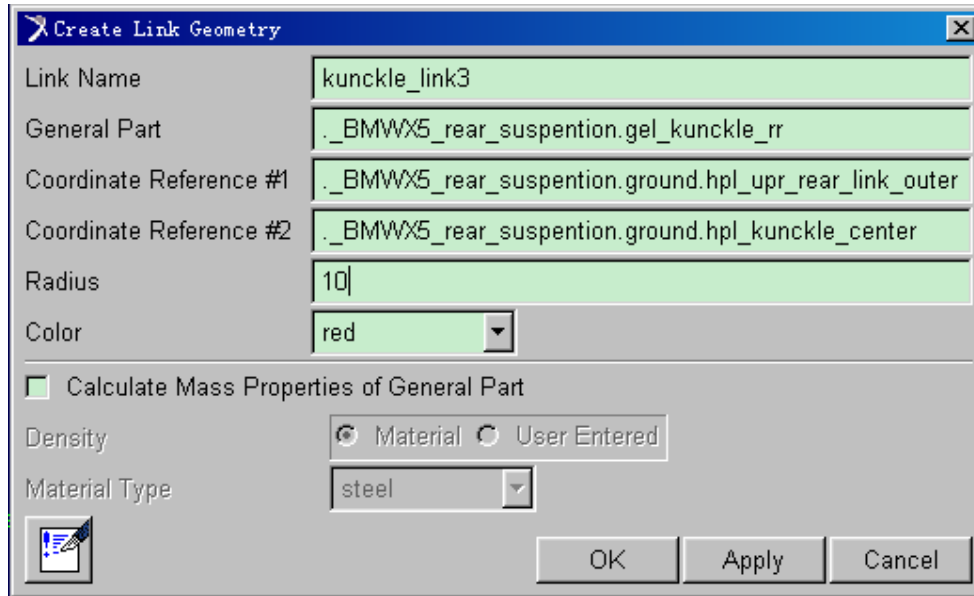
点击 Apply，修改对话框内容如下：

**Create Link Geometry**

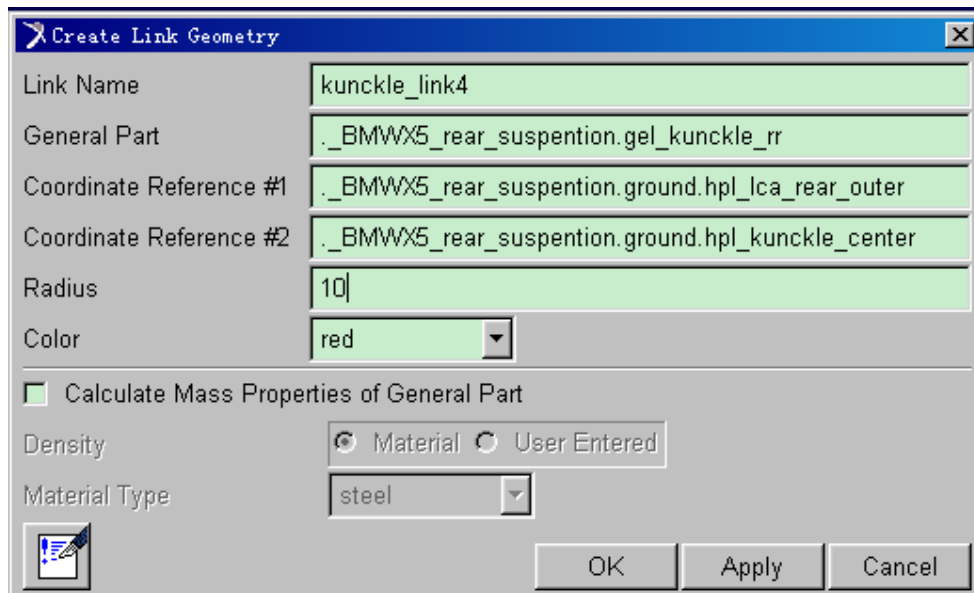
Link Name	kunckle_link2
General Part	._BMW5_rear_suspention.gel_kunckle_rr
Coordinate Reference #1	._BMW5_rear_suspention.ground.hpl_upr_front_link_outer
Coordinate Reference #2	._BMW5_rear_suspention.ground.hpl_kunckle_center
Radius	10
Color	red
<input type="checkbox"/> Calculate Mass Properties of General Part	
Density	<input checked="" type="radio"/> Material <input type="radio"/> User Entered
Material Type	steel

 OK Apply Cancel

点击 Apply，修改对话框内容如下：



点击 Apply，修改对话框内容如下：

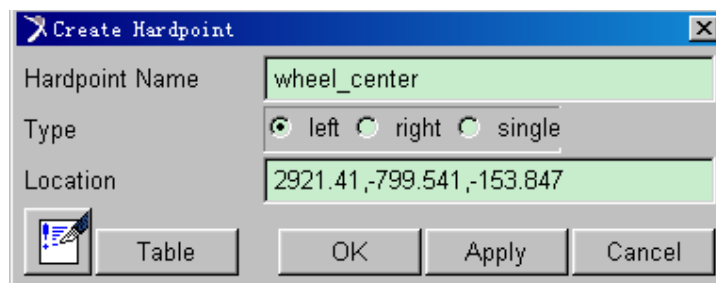


点击 OK。

## 4.8 建立轮毂

### 4.8.1 建立轮心点坐标

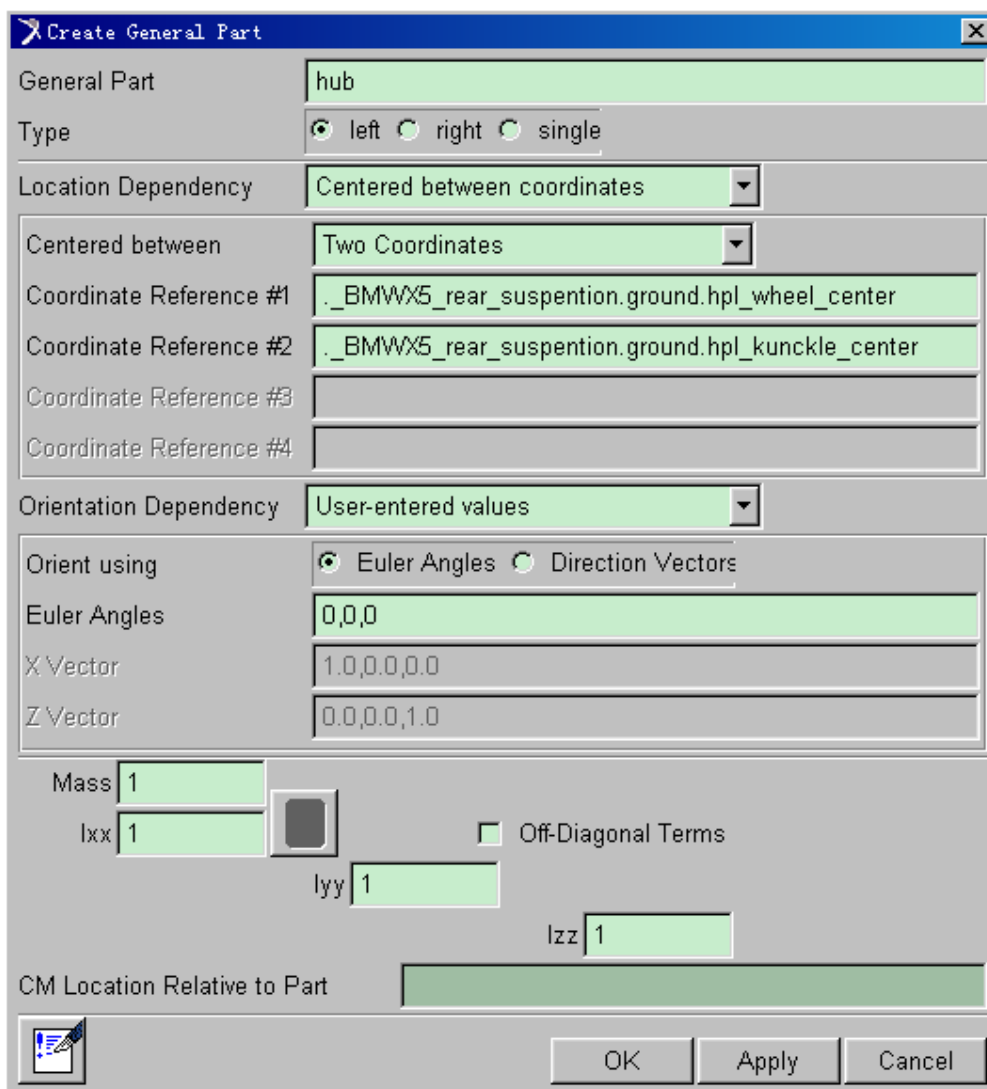
从下拉菜单选择 Build>Hardpoint>New，设置对话框内容如下：



点击 OK。

#### 4.8.2 建立轮毂 part

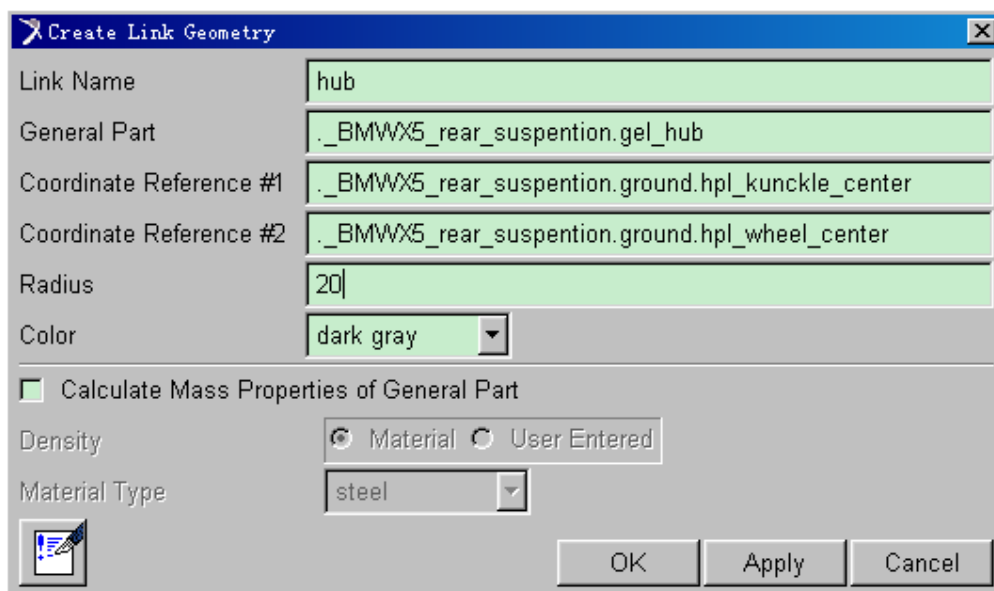
从菜单选择 Build>Parts>General Part>New, 在出现的对话框里输入以下内容:



点击 OK。

### 4.8.3 建立轮毂的几何体 Link

从菜单选择 Build>Geometry>Link>New, 设置对话框内容如下:

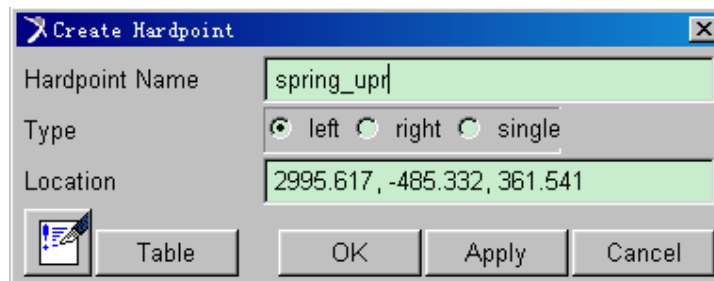


点击 OK。

## 4.9 创建弹簧

### 4.9.1 建立弹簧上安装点

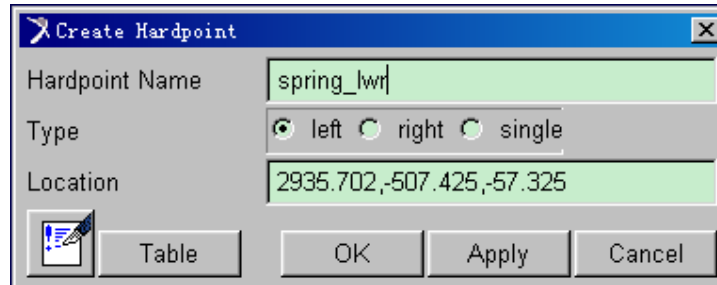
从下拉菜单选择 Build>Hardpoint>New, 设置对话框内容如下:



点击 Apply。

### 4.9.2 建立弹簧下安装点

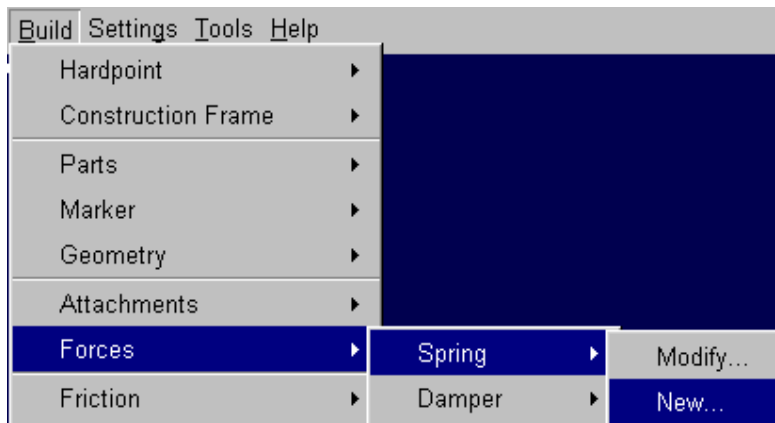
修改上面对话框内容如下:



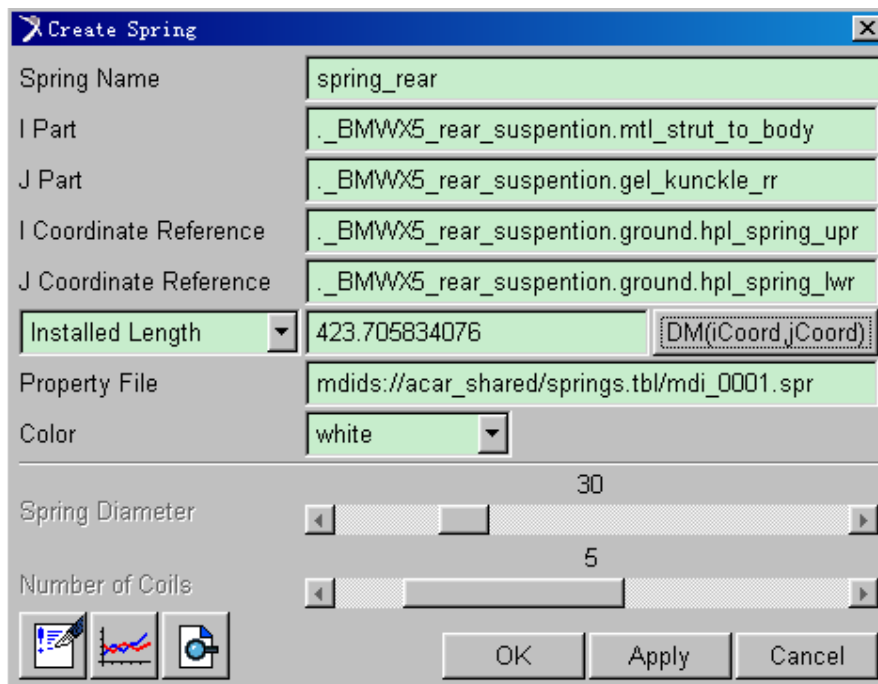
点击 OK。

#### 4.9.3 创建弹簧

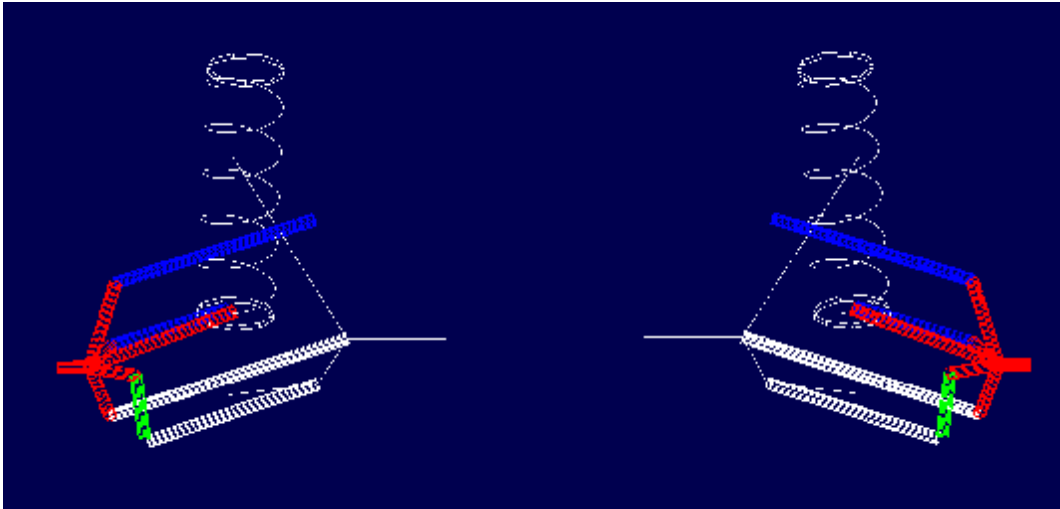
从菜单选择 Build>Forces>Spring>New。



在出现的对话框里输入如下内容：



点击 OK，创建的后螺旋弹簧如图所示：



#### 4.9.4 建立连接转向节和弹簧间的 Link

从菜单选择 Build>Geometry>Link>New, 设置对话框内容如下:

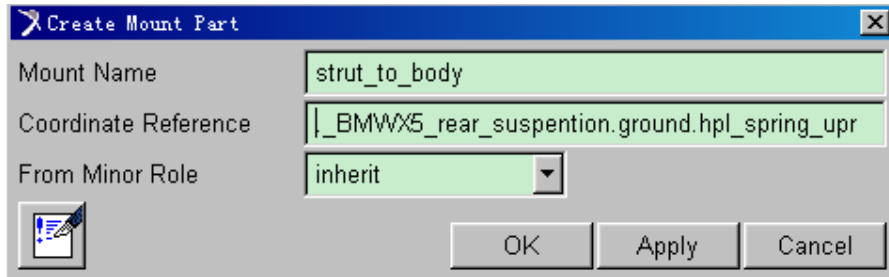
Create Link Geometry	
Link Name	kunckle_link5
General Part	._BMW5_rear_suspention.gel_kunckle_rr
Coordinate Reference #1	._BMW5_rear_suspention.ground.hpl_kunckle_center
Coordinate Reference #2	._BMW5_rear_suspention.ground.hpl_spring_lwr
Radius	10
Color	red
<input type="checkbox"/> Calculate Mass Properties of General Part	
Density	<input checked="" type="radio"/> Material <input type="radio"/> User Entered
Material Type	steel
<input type="button" value="OK"/> <input type="button" value="Apply"/> <input type="button" value="Cancel"/>	

点击 OK。

#### 4.9.5 建立后减振器与车身间的 Mount part

从菜单选择 Build>Parts>Mount>New, 在出现的对话框里输入以下内容:



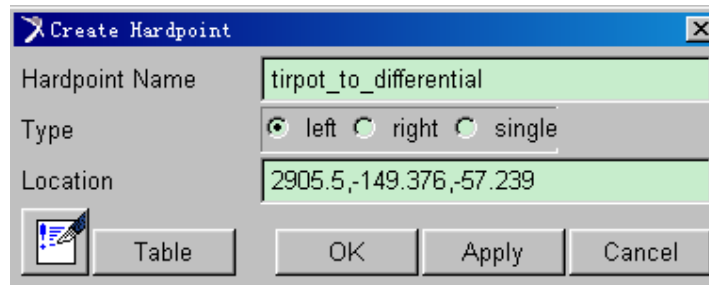


点击 OK。

## 4.10 创建驱动轴半轴

### 4.10.1 建立半轴内点

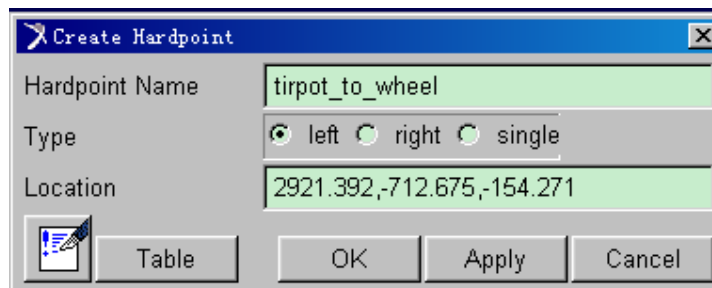
从下拉菜单选择 Build>Hardpoint>New，设置对话框内容如下：



点击 Apply。

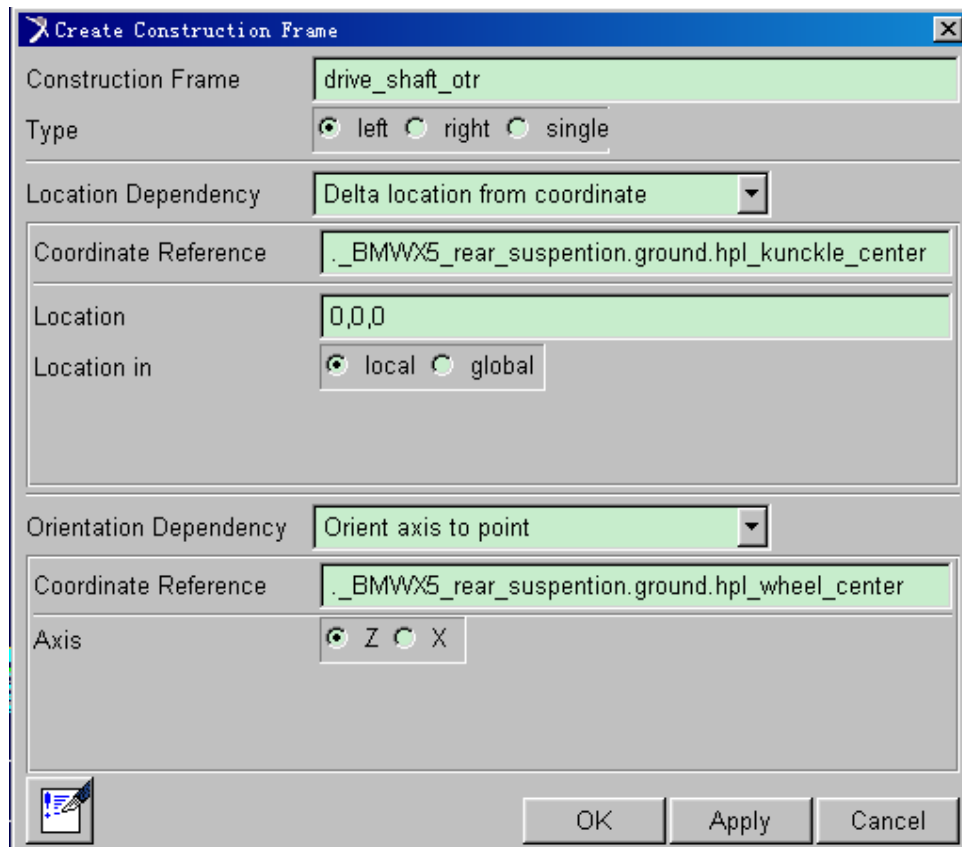
### 4.10.2 建立半轴外点及相应的 Construction Frame

修改上面的对话框内容：



点击 OK。

建立驱动轴外点处的 Construction Frame，从下拉菜单选择 Build>Construction Frame>New。



点击 OK。

#### 4.10.3 建立驱动轴的 Part

从菜单选择 Build>Parts>General Part>New, 在出现的对话框里输入以下内容:

**Create General Part**

General Part:

Type: ☒ left ☐ right ☐ single

Location Dependency:

Centered between:

Coordinate Reference #1:

Coordinate Reference #2:

Coordinate Reference #3:

Coordinate Reference #4:

Orientation Dependency:

Orient using: ☒ Euler Angles ☐ Direction Vectors

Euler Angles:

X Vector:

Z Vector:


Mass:

Ixx:  ☐ Off-Diagonal Terms

Iyy:

Izz:

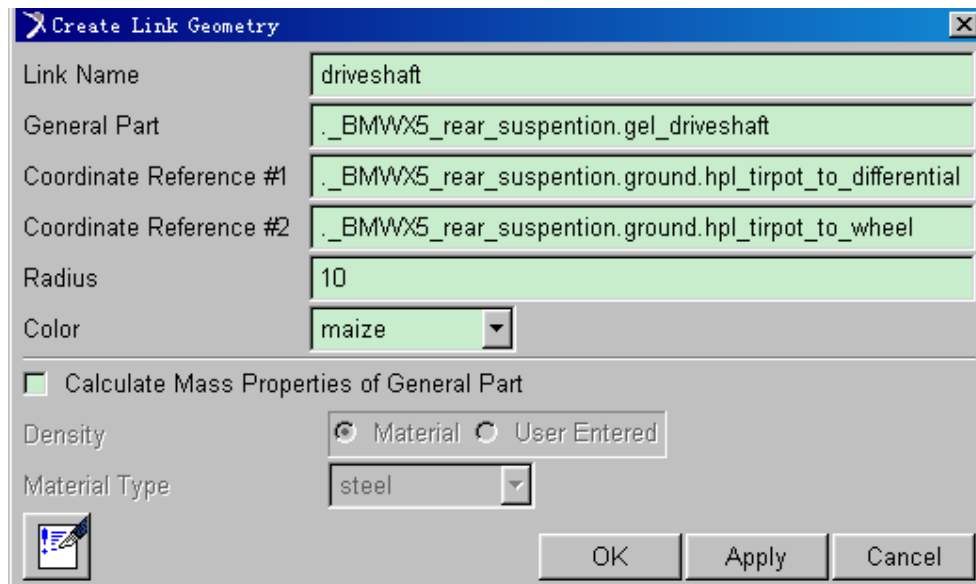
CM Location Relative to Part:



点击 OK。

#### 4.10.4 建立驱动轴的 Link

从菜单选择 Build>Geometry>Link>New，设置对话框内容如下：



The image shows a software dialog box titled "Create Link Geometry". It contains several input fields and options:

- Link Name:** driveshaft
- General Part:** .\_BMW5\_rear\_suspention.gel\_driveshaft
- Coordinate Reference #1:** .\_BMW5\_rear\_suspention.ground.hpl\_tirpot\_to\_differential
- Coordinate Reference #2:** .\_BMW5\_rear\_suspention.ground.hpl\_tirpot\_to\_wheel
- Radius:** 10
- Color:** maize (with a color selection icon)
- Calculate Mass Properties of General Part:** ☐ (unchecked)
- Density:** Material (selected radio button), User Entered (unselected radio button)
- Material Type:** steel (with a dropdown arrow)
- Buttons:** OK, Apply, Cancel

点击 OK。

#### 4.10.5 建立 Tripot 的 Part

从菜单选择 Build>Parts>General Part>New, 在出现的对话框里输入以下内容:

**Modify General Part**

General Part:

Type: ☒ left ☐ right ☐ single

Location Dependency:

Coordinate Reference:

Location:

Location in: ☒ local ☐ global


Orientation Dependency:

Coordinate Reference #1:

Coordinate Reference #2:

Axes: ☒ ZX ☐ XZ

Mass:


Ixx:  

Iyy:

Izz:

Off-Diagonal Terms: ☐

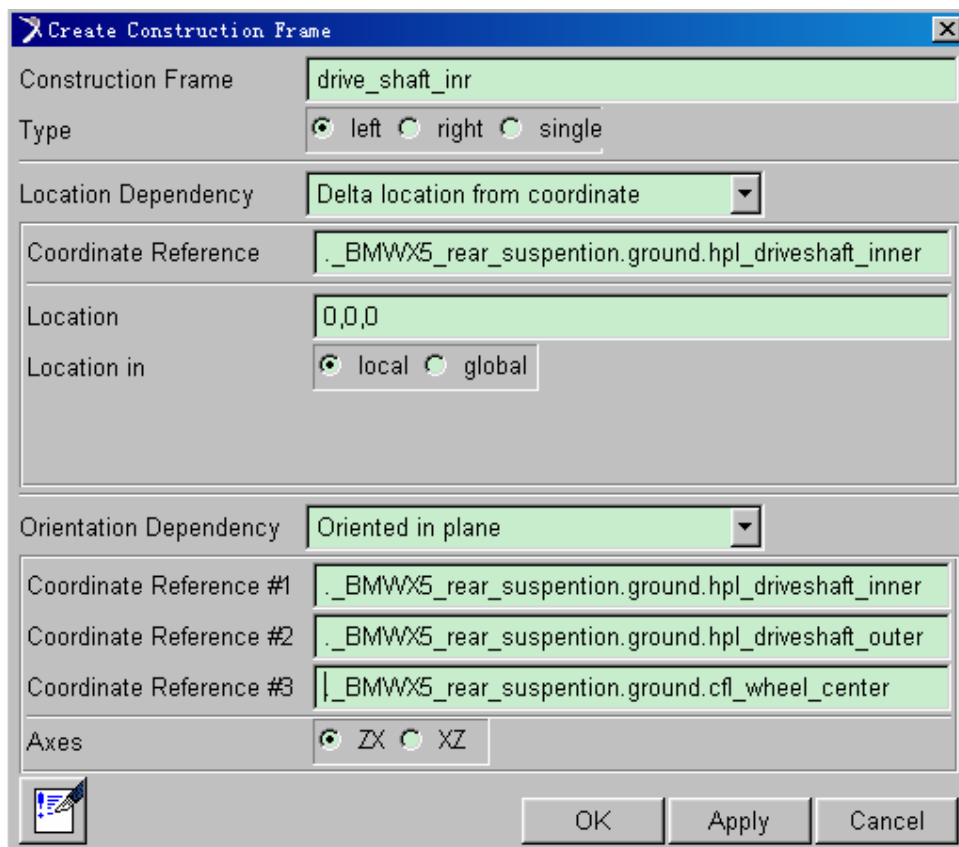
CM Location Relative to Part:



点击 OK。

#### 4.10.6 建立驱动轴内点处的 Construction Frame

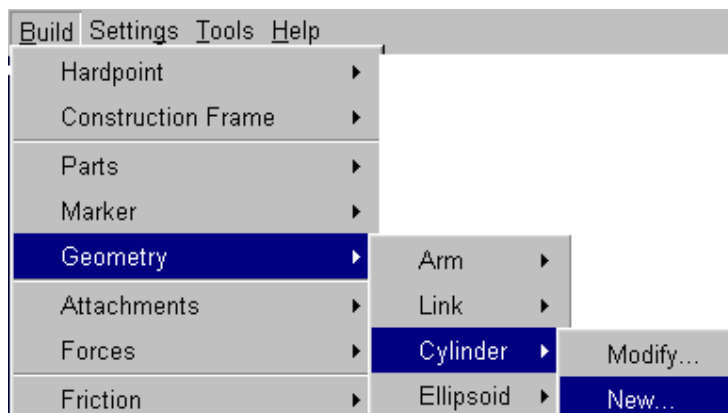
从菜单选择 Build>Construction Frame>New。



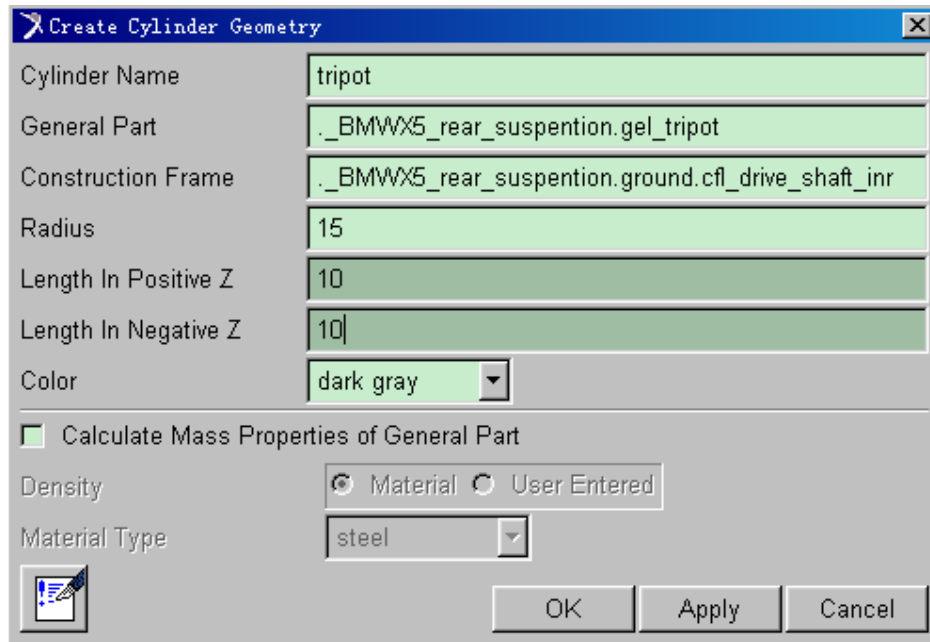
点击 OK。

#### 4.10.7 建立 Tripot 的几何体

从菜单选择 Build>Geometry>Cylinder>New。



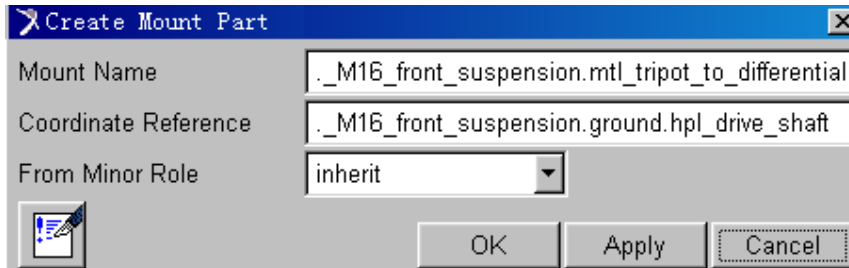
在出现的对话框里输入以下内容：



点击 OK。

#### 4.11 建立球笼到后差速器的 Mount part

从菜单选择 Build>Parts>Mount>New, 在出现的对话框里输入以下内容:

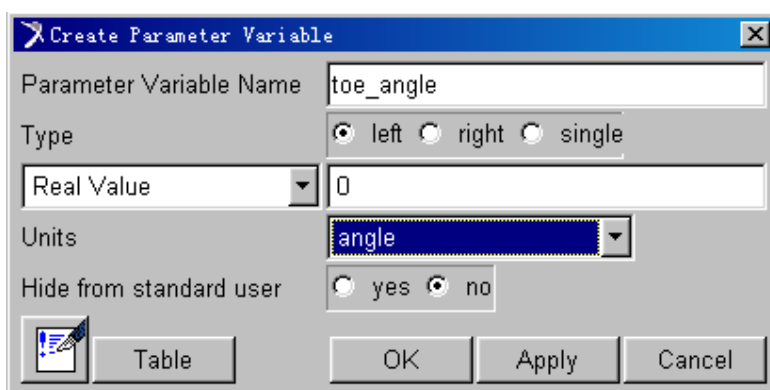


点击 OK。

#### 4.12 建立后悬架的前束和外倾角参数变量

从菜单选择 Build>Suspension Parameters>new。

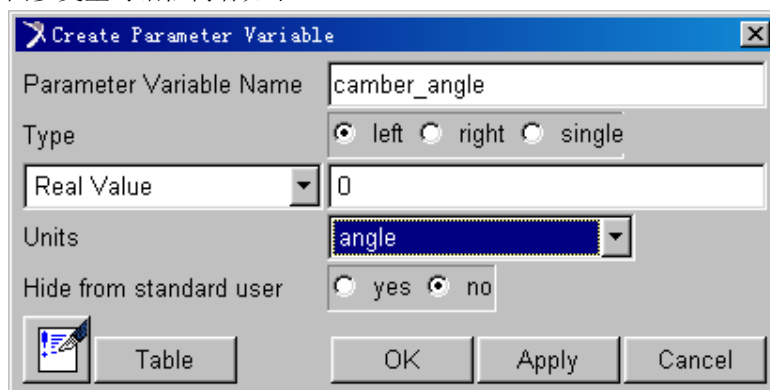
1) 建立参变量 toe\_angle



点击 Apply。

### 2) 建立参变量 Camber Values

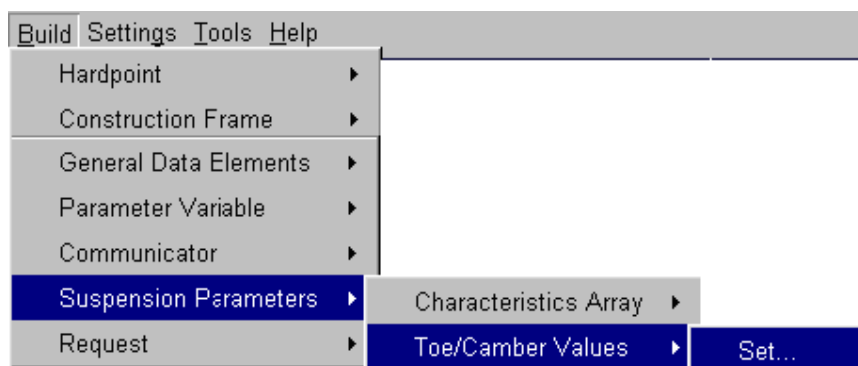
修改上面参变量对话框内容如下：



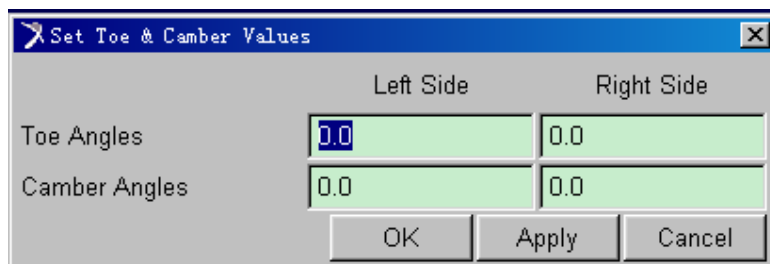
点击 OK。

### 3) 修改悬架参数

从菜单选择 Build>Suspension Parameters>New。



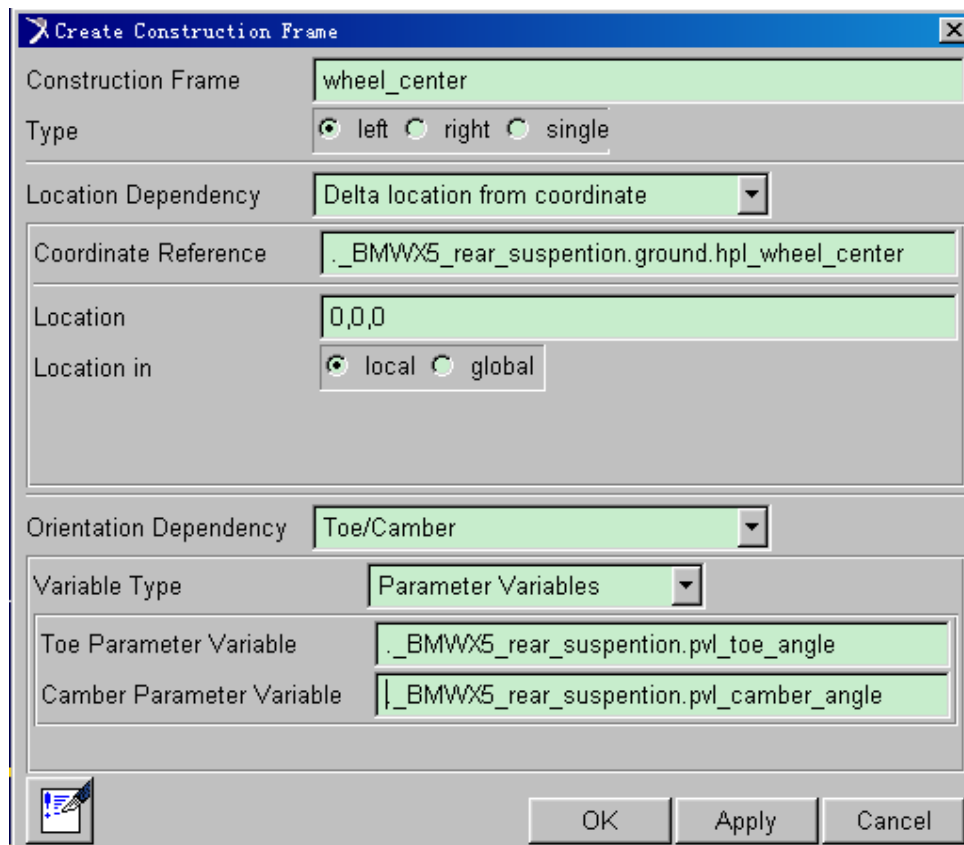
设定前束和外倾值，这里我们不妨先默认为零。





## 4.13 建立轮心的 Construction Frame

创建该 Construction Frame 是用来控制轮胎的定位参数。从菜单选择 Build>Construction Frame>New, 在出现的对话框里输入以下内容:



The 'Create Construction Frame' dialog box contains the following fields and options:

- Construction Frame:** wheel\_center
- Type:** ☒ left ☐ right ☐ single
- Location Dependency:** Delta location from coordinate
- Coordinate Reference:** .\_BMW5\_rear\_suspention.ground.hpl\_wheel\_center
- Location:** 0,0,0
- Location in:** ☒ local ☐ global
- Orientation Dependency:** Toe/Camber
- Variable Type:** Parameter Variables
- Toe Parameter Variable:** .\_BMW5\_rear\_suspention.pvl\_toe\_angle
- Camber Parameter Variable:** |\_BMW5\_rear\_suspention.pvl\_camber\_angle

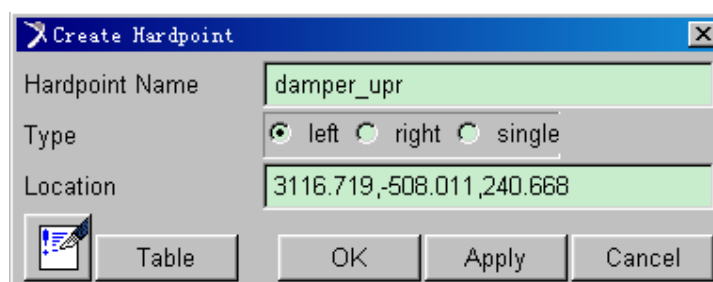
Buttons at the bottom: OK, Apply, Cancel.

点击 OK。

## 4.14 创建减振器

### 4.14.1 建立减振器硬点

1) 建立减振器上点:

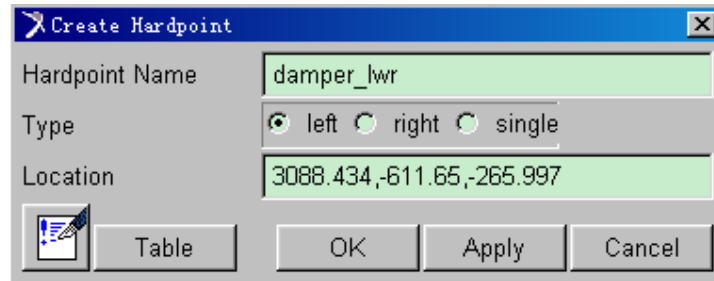


The 'Create Hardpoint' dialog box contains the following fields and options:

- Hardpoint Name:** damper\_upr
- Type:** ☒ left ☐ right ☐ single
- Location:** 3116.719,-508.011,240.668

Buttons at the bottom: Table, OK, Apply, Cancel.

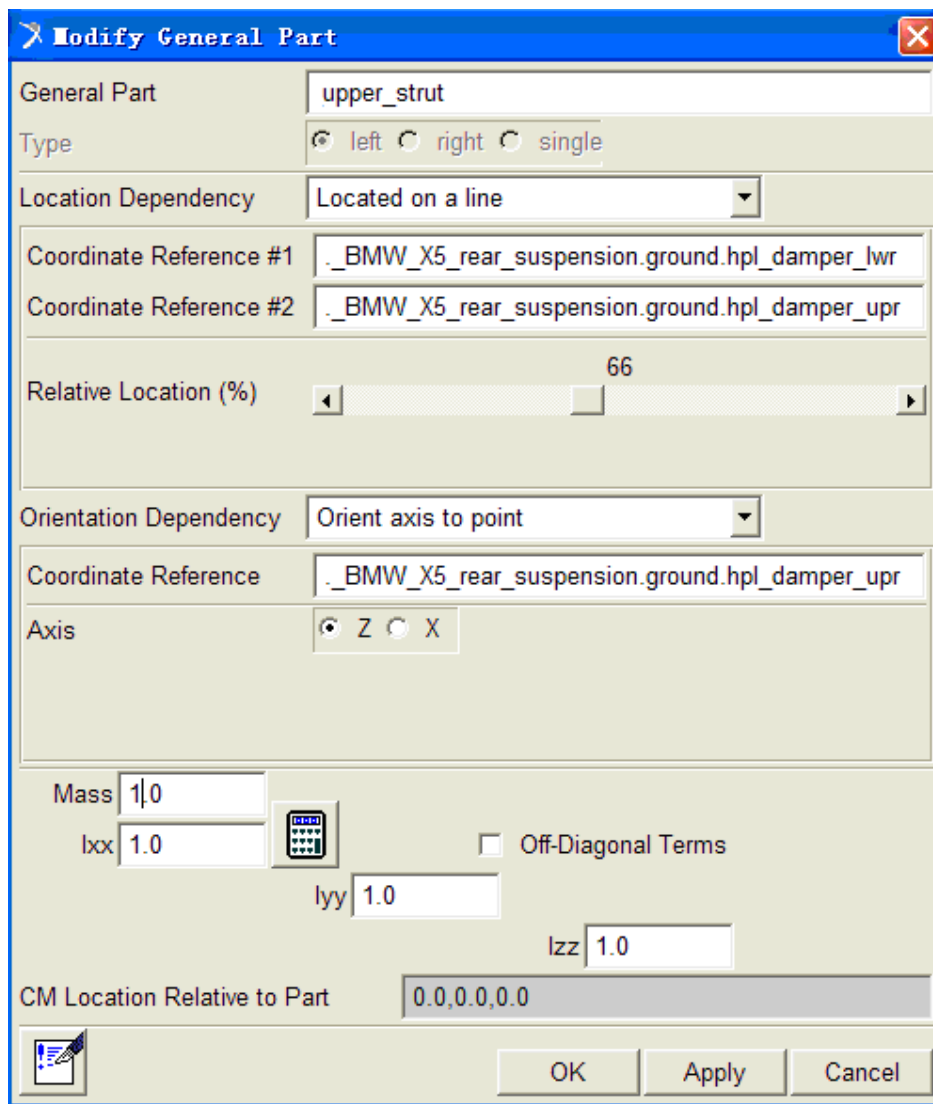
2) 建立减振器下点:



#### 4.14.2 建立减振器上下两部分 part

##### 1) 上半部分 upper\_strut

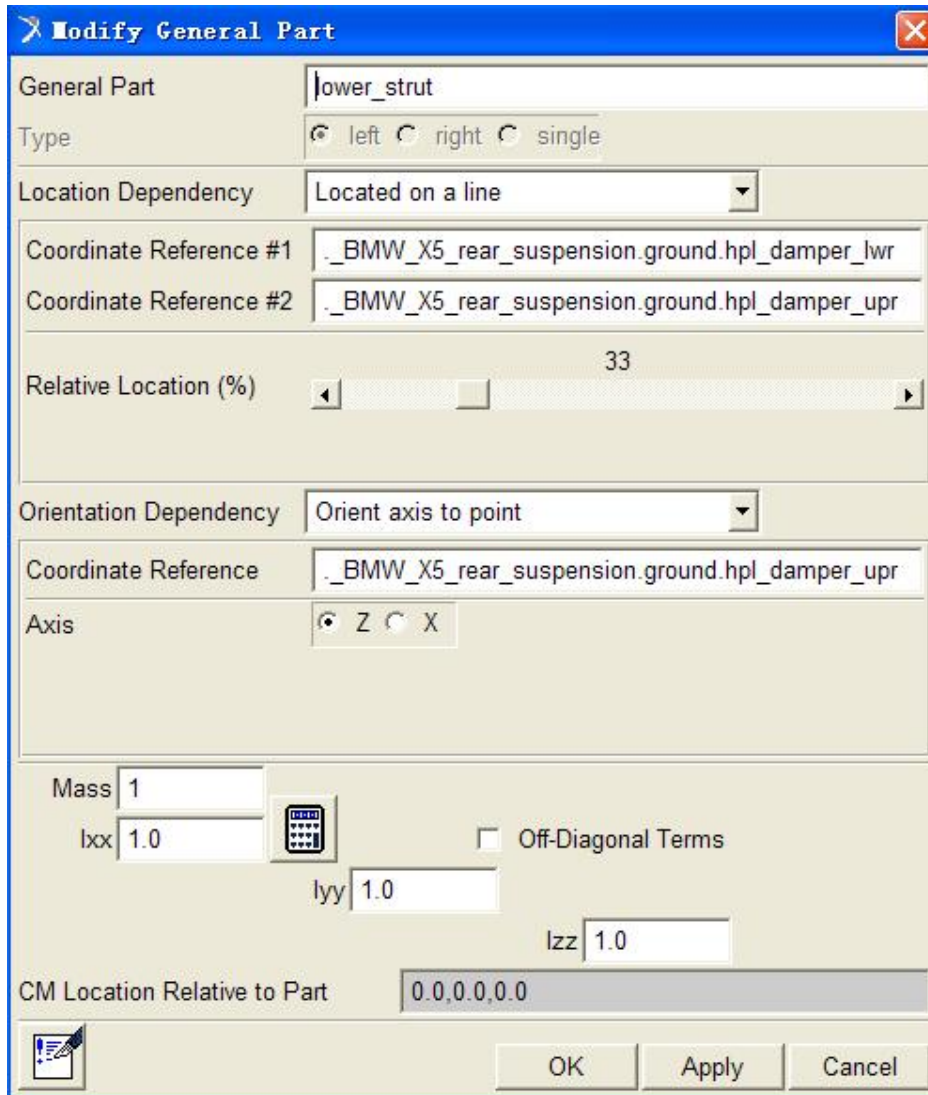
从菜单选择 Build>Parts>General Part>New, 在出现的对话框里输入以下内容:



点击 Apply。

##### 2) 下半部分 lower\_strut

修改对话框内容如下：



**Modify General Part**

General Part: lower\_strut

Type: ☒ left ☐ right ☐ single

Location Dependency: Located on a line

Coordinate Reference #1: . \_BMW\_X5\_rear\_suspension.ground.hpl\_damper\_lwr

Coordinate Reference #2: . \_BMW\_X5\_rear\_suspension.ground.hpl\_damper\_upr

Relative Location (%): 33

Orientation Dependency: Orient axis to point

Coordinate Reference: . \_BMW\_X5\_rear\_suspension.ground.hpl\_damper\_upr

Axis: ☒ Z ☐ X

Mass: 1

Ixx: 1.0

Iyy: 1.0

Izz: 1.0

Off-Diagonal Terms: ☐

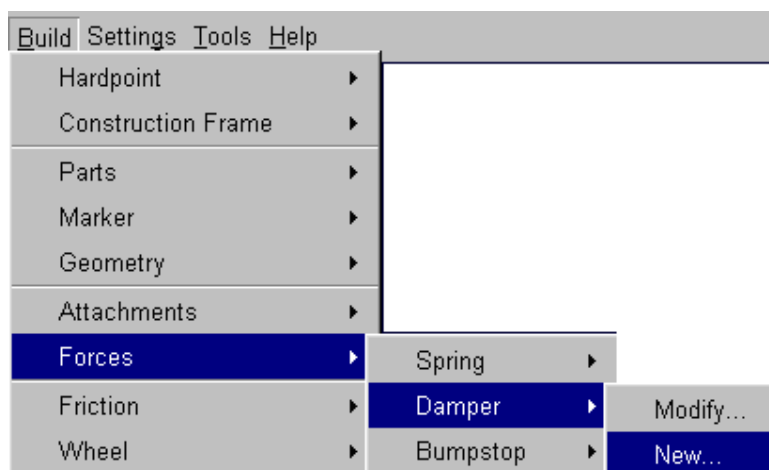
CM Location Relative to Part: 0.0,0.0,0.0

Buttons: OK, Apply, Cancel

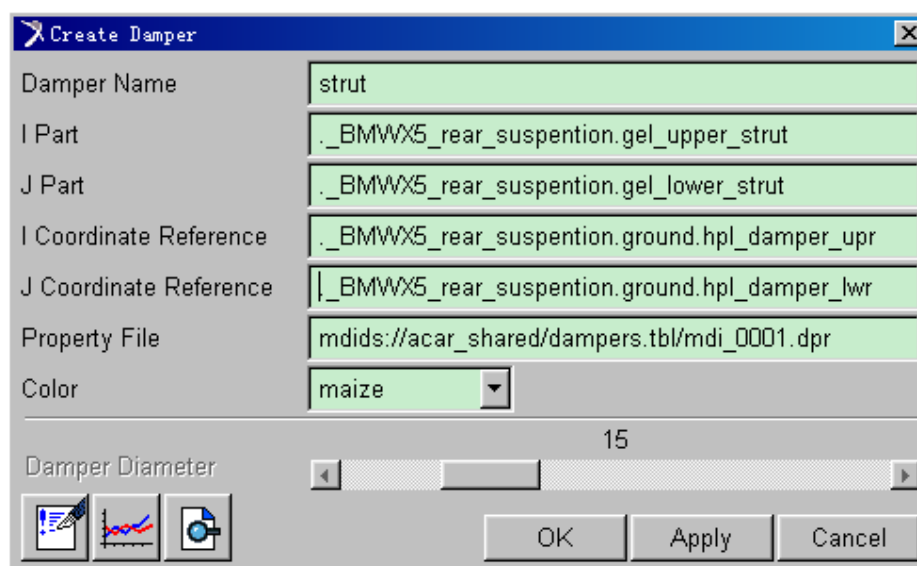
点击 OK。

#### 4.14.3 建立减振器阻尼力

从菜单选择 Build>Settings>Forces>Damper>new。



在出现的对话框里填入以下内容:



点击 OK。

#### 4.14.4 创建减振器上下限位块

- 1) 建立 Top Mount 上的 Construction Frame  
从菜单选择 Build>Construction Frame>New。

**Modify Construction Frame**

Construction Frame:

Type: ☒ left ☐ right ☐ single

Location Dependency:

Coordinate Reference:

Location:

Location in: ☒ local ☐ global


Orientation Dependency:

Orient using: ☒ Euler Angles ☐ Direction Vectors

Euler Angles:

X Vector:

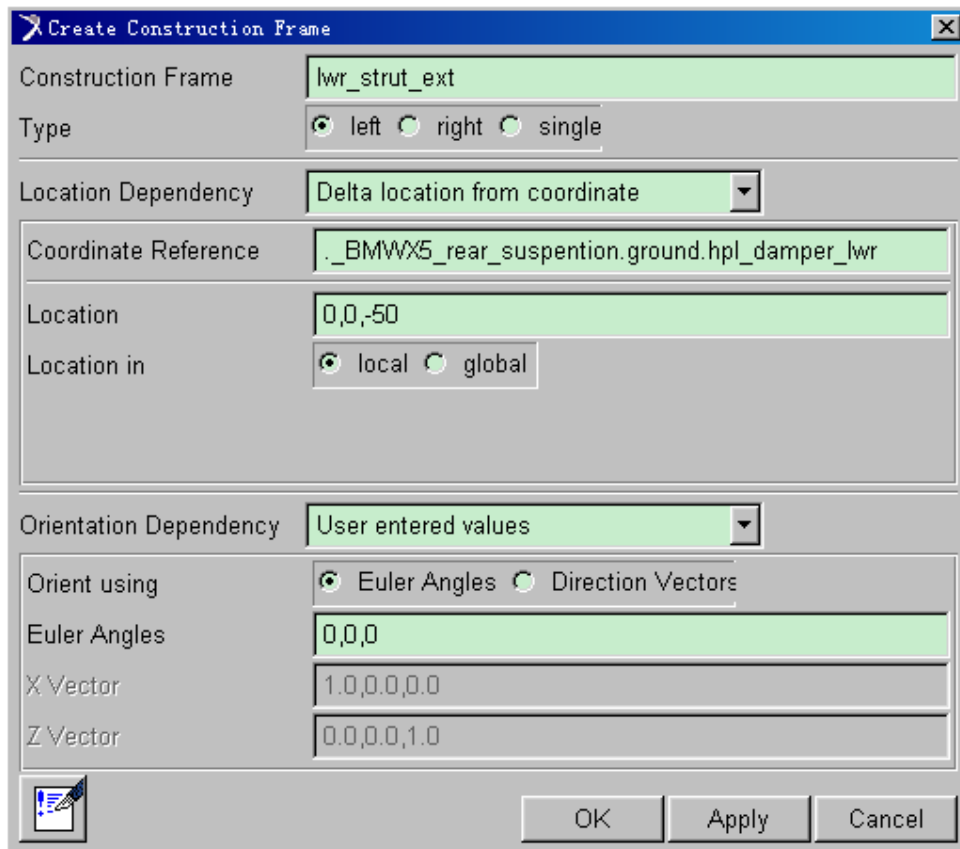
Z Vector:



点击 Apply。

2) 建立减振器下端的 Frame

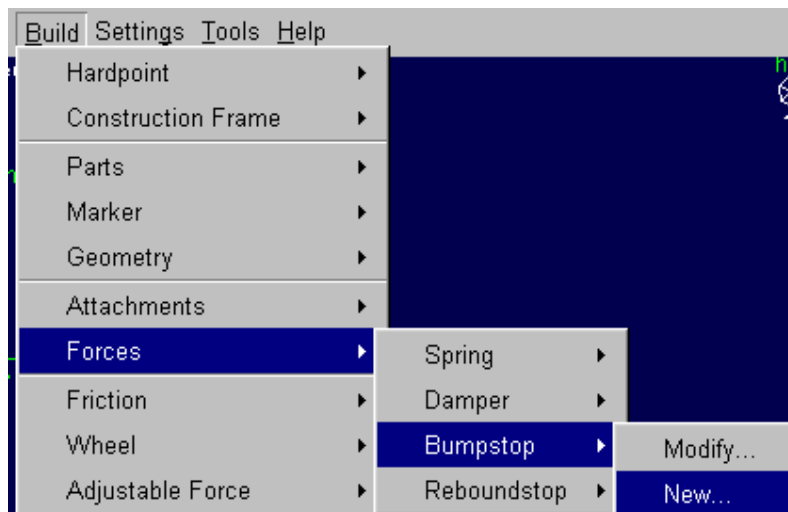
修改上面的对话框内容：



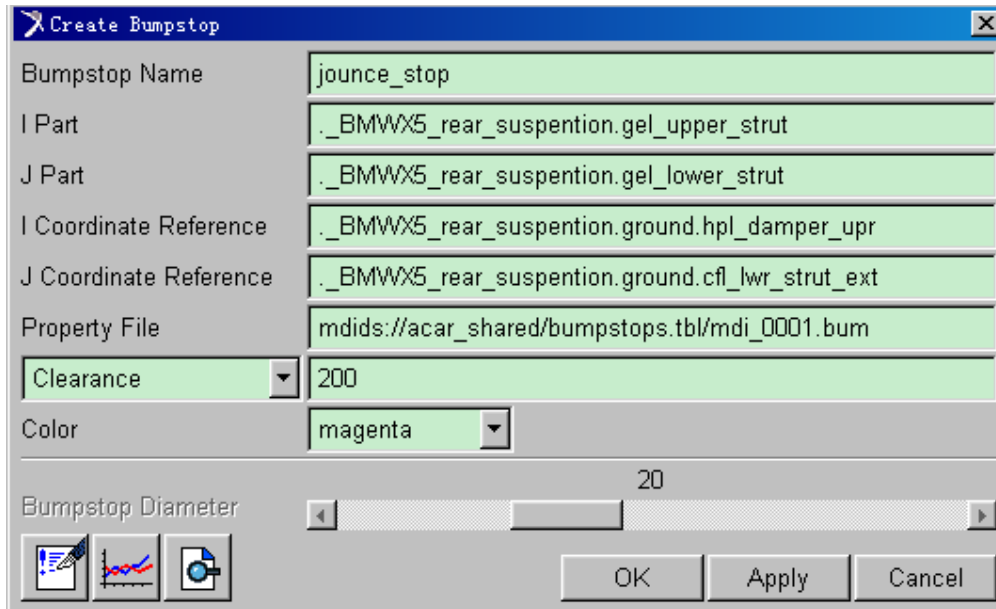
点击 OK。

### 3) 建立 Bumpstop

从菜单选择 Build>Forces>Bumpstop>New。



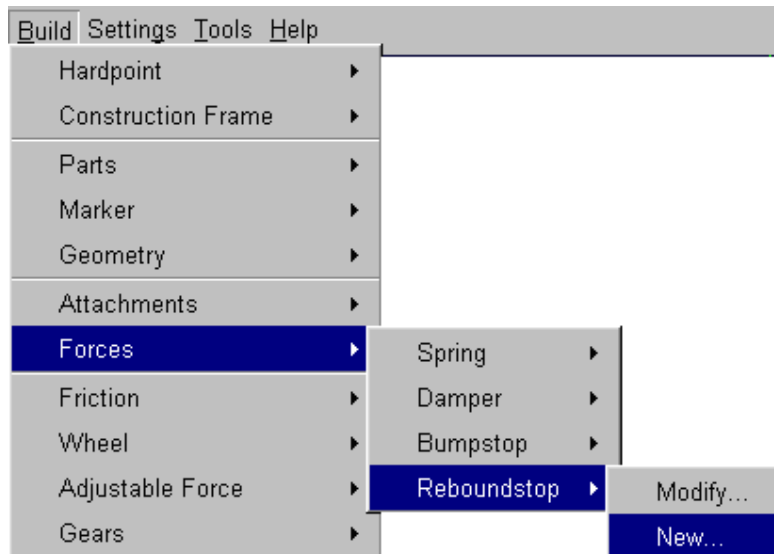
在出现的对话框里填入内容如下：



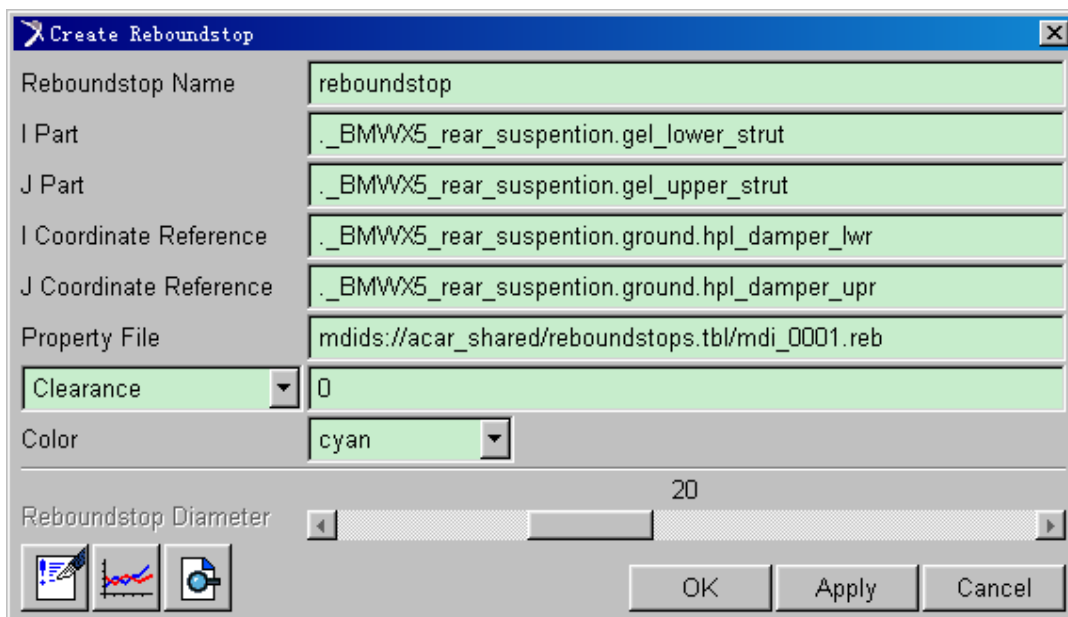
点击 OK。

#### 4) 建立 Reboundstop

从菜单选择 Build>Forces>Reboundstop>New。



在出现的对话框里填入内容如下：

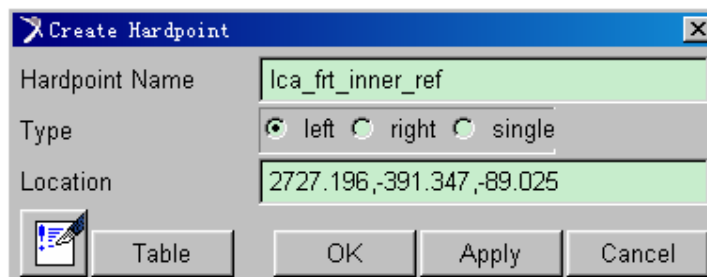


点击 OK。

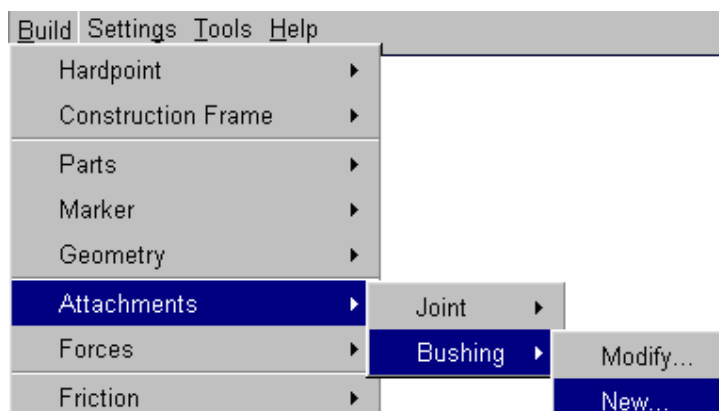
## 4.15 创建部件间的衬套连接

### 4.15.1 创建下控制臂与副车架连接衬套

1) 建立下控制臂前内点参考点

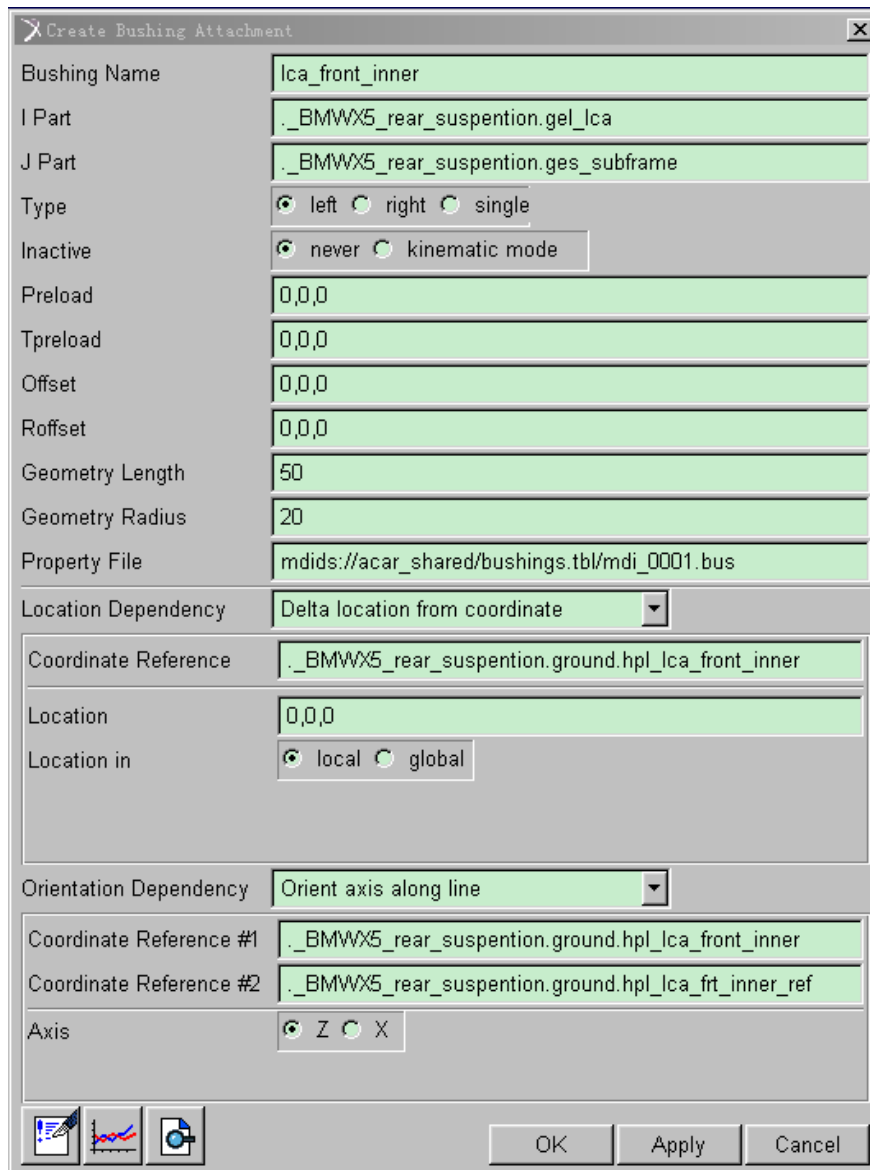


从菜单选择 Build>Attachments>Bushings>New。





在出现的对话框里填入内容如下：



The image shows a 'Create Bushing Attachment' dialog box with the following fields and values:

Field	Value
Bushing Name	lca_front_inner
I Part	._BMW5_rear_suspention.gel_lca
J Part	._BMW5_rear_suspention.ges_subframe
Type	<input checked="" type="radio"/> left <input type="radio"/> right <input type="radio"/> single
Inactive	<input checked="" type="radio"/> never <input type="radio"/> kinematic mode
Preload	0,0,0
Tpreload	0,0,0
Offset	0,0,0
Roffset	0,0,0
Geometry Length	50
Geometry Radius	20
Property File	mdids://acar_shared/bushings.tbl/mdi_0001.bus
Location Dependency	Delta location from coordinate
Coordinate Reference	._BMW5_rear_suspention.ground.hpl_lca_front_inner
Location	0,0,0
Location in	<input checked="" type="radio"/> local <input type="radio"/> global
Orientation Dependency	Orient axis along line
Coordinate Reference #1	._BMW5_rear_suspention.ground.hpl_lca_front_inner
Coordinate Reference #2	._BMW5_rear_suspention.ground.hpl_lca_frt_inner_ref
Axis	<input checked="" type="radio"/> Z <input type="radio"/> X

At the bottom, there are three icons (a document, a graph, and a bushing) and three buttons: OK, Apply, and Cancel.




点击 Apply 完成下控制臂前内衬套。

2) 下控制臂后内衬套

修改上面的对话框内容：

**Create Bushing Attachment**

Bushing Name	lca_rear_inner
I Part	._BMWx5_rear_suspention.ges_subframe
J Part	._BMWx5_rear_suspention.gel_lca
Type	<input checked="" type="radio"/> left <input type="radio"/> right <input type="radio"/> single
Inactive	<input checked="" type="radio"/> never <input type="radio"/> kinematic mode
Preload	0,0,0
Tpreload	0,0,0
Offset	0,0,0
Roffset	0,0,0
Geometry Length	20
Geometry Radius	30
Property File	mdids://acar_shared/bushings.tbl/mdi_0001.bus
Location Dependency	Delta location from coordinate
Coordinate Reference	._BMWx5_rear_suspention.ground.hpl_lca_rear_inner
Location	0,0,0
Location in	<input checked="" type="radio"/> local <input type="radio"/> global
Orientation Dependency	Orient axis along line
Coordinate Reference #1	._BMWx5_rear_suspention.ground.hpl_lca_rear_inner
Coordinate Reference #2	._BMWx5_rear_suspention.ground.hpl_lca_front_inner
Axis	<input checked="" type="radio"/> Z <input type="radio"/> X

点击 Apply。

#### 4.15.2 创建上连杆与副车架连接衬套

- 1) 上前控制臂与副车架连接衬套  
修改上面的对话框内容如下：

Create Bushing Attachment	
Bushing Name	upr_front_link_to_subframe
I Part	._BMW5_rear_suspention.gel_upper_front_link
J Part	._BMW5_rear_suspention.ges_subframe
Type	<input checked="" type="radio"/> left <input type="radio"/> right <input type="radio"/> single
Inactive	<input checked="" type="radio"/> never <input type="radio"/> kinematic mode
Preload	0,0,0
Tpreload	0,0,0
Offset	0,0,0
Roffset	0,0,0
Geometry Length	20
Geometry Radius	30
Property File	mdids://acar_shared/bushings.tbl/mdi_0001.bus
Location Dependency	Delta location from coordinate
Coordinate Reference	._BMW5_rear_suspention.ground.hpl_upr_front_link_inner
Location	0,0,0
Location in	<input checked="" type="radio"/> local <input type="radio"/> global
Orientation Dependency	User entered values
Orient using	<input checked="" type="radio"/> Euler Angles <input type="radio"/> Direction Vectors
Euler Angles	-90, 90, 180
X Vector	0.0,1.0,0.0
Z Vector	-1.0,0.0,0.0




点击 Apply。

2) 上后连杆与副车架连接衬套

修改上面的对话框内容如下：

**Create Bushing Attachment**

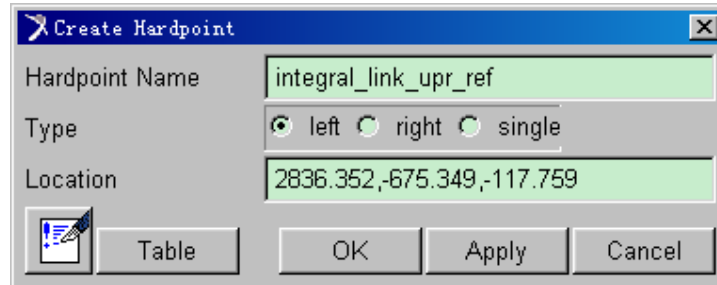
Bushing Name	upr_link_rr_to_subframe
I Part	._BMW5_rear_suspention.ges_subframe
J Part	._BMW5_rear_suspention.gel_upper_rear_link
Type	<input checked="" type="radio"/> left <input type="radio"/> right <input type="radio"/> single
Inactive	<input checked="" type="radio"/> never <input type="radio"/> kinematic mode
Preload	0,0,0
Tpreload	0,0,0
Offset	0,0,0
Roffset	0,0,0
Geometry Length	20
Geometry Radius	30
Property File	mdids://acar_shared/bushings.tbl/mdi_0001.bus
Location Dependency	Delta location from coordinate
Coordinate Reference	._BMW5_rear_suspention.ground.hpl_upr_rear_link_inner
Location	0,0,0
Location in	<input checked="" type="radio"/> local <input type="radio"/> global
Orientation Dependency	User entered values
Orient using	<input checked="" type="radio"/> Euler Angles <input type="radio"/> Direction Vectors
Euler Angles	-90, 90, 180
X Vector	0,0,1,0,0,0
Z Vector	-1,0,0,0,0,0

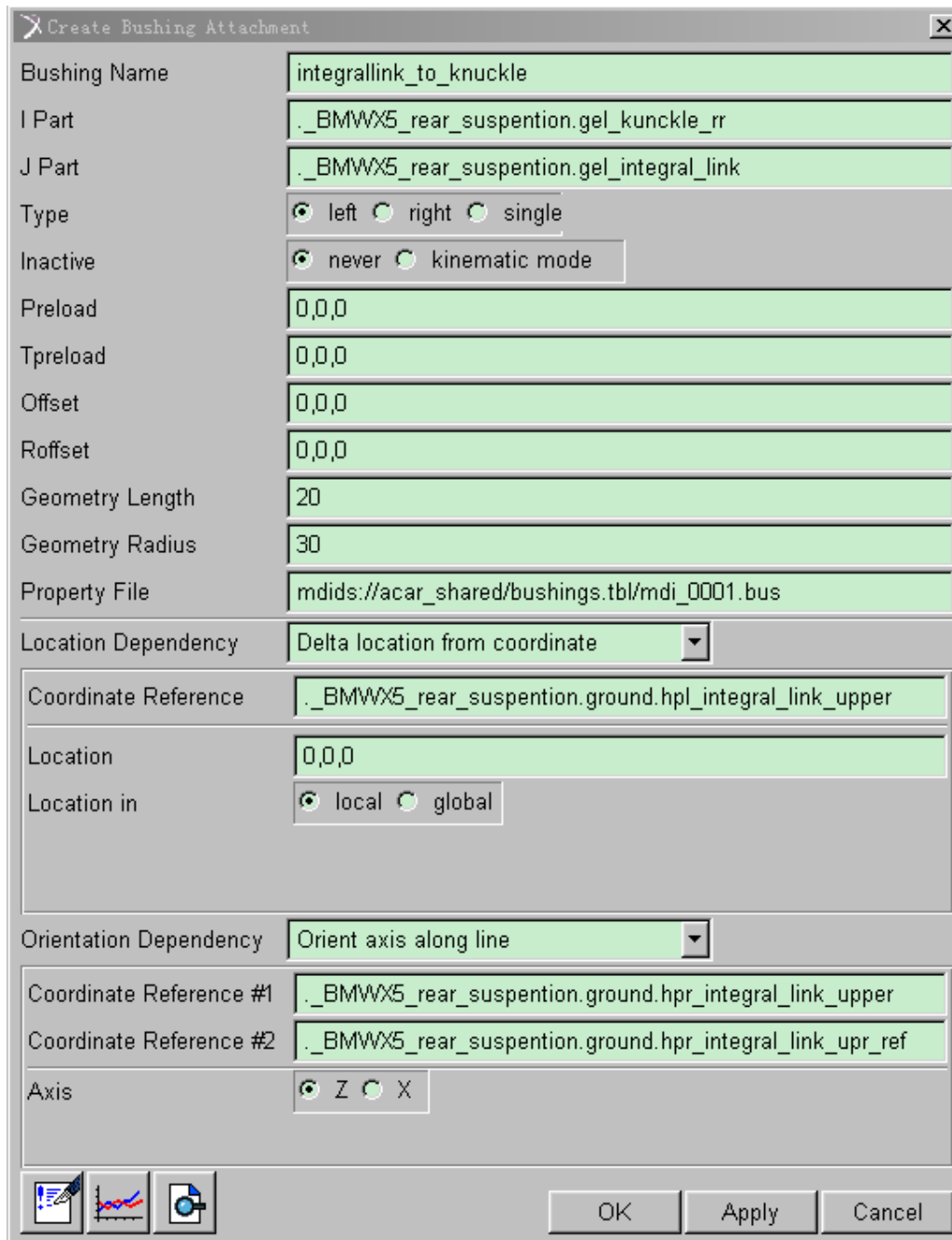
点击 Apply。

#### 4.15.3 创建小连接板连接衬套

- 1) 创建小连接板与转向节连接衬套  
创建小连接板上点衬套轴线参考点



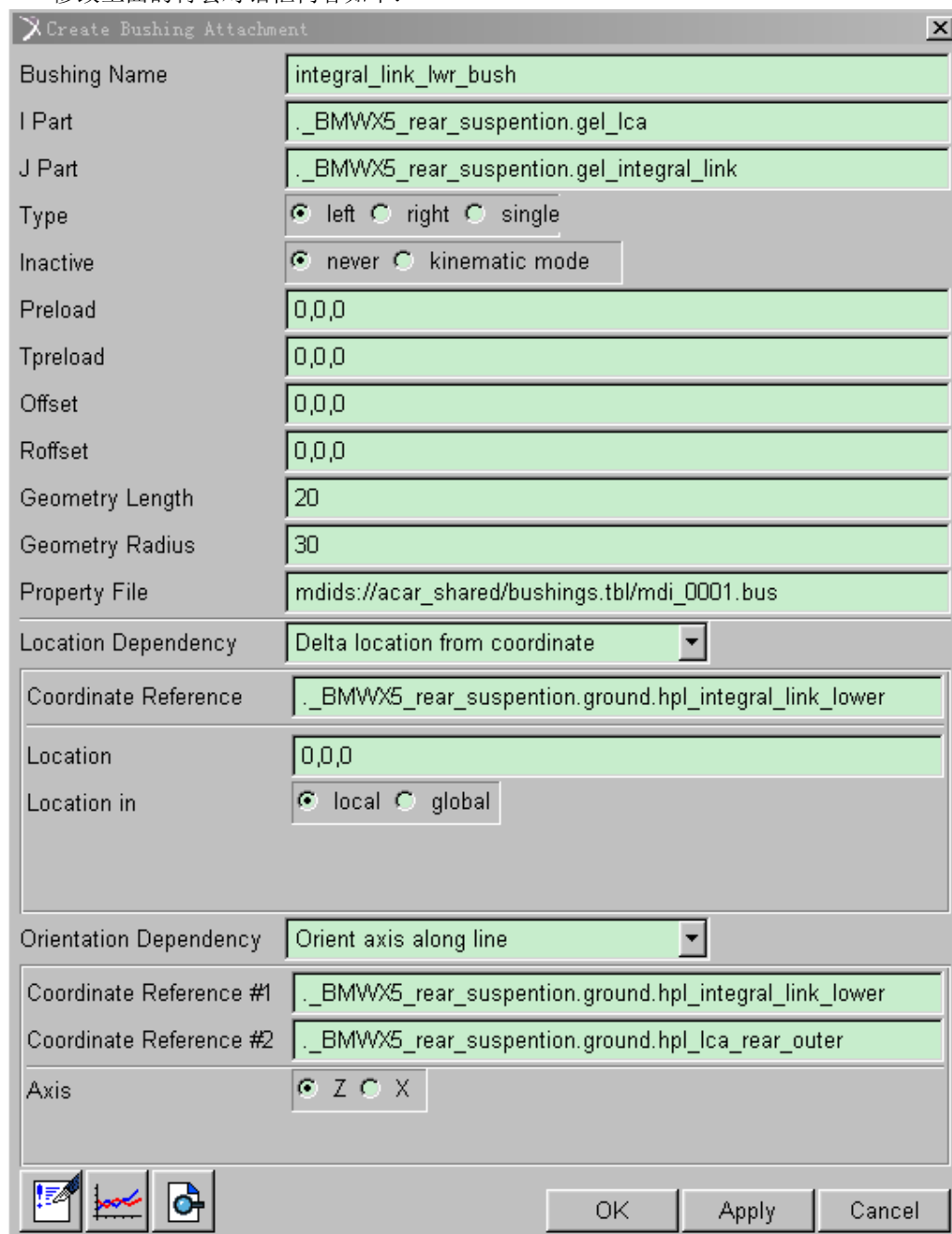
修改上面的衬套对话框内容如下：



点击 Apply。

2) 创建小连接板与下控制臂连接衬套

修改上面的衬套对话框内容如下：



The image shows a 'Create Bushing Attachment' dialog box with the following fields and values:

Field	Value
Bushing Name	integral_link_lwr_bush
I Part	._BMWV5_rear_suspention.gel_lca
J Part	._BMWV5_rear_suspention.gel_integral_link
Type	<input checked="" type="radio"/> left <input type="radio"/> right <input type="radio"/> single
Inactive	<input checked="" type="radio"/> never <input type="radio"/> kinematic mode
Preload	0,0,0
Tpreload	0,0,0
Offset	0,0,0
Roffset	0,0,0
Geometry Length	20
Geometry Radius	30
Property File	mdids://acar_shared/bushings.tbl/mdi_0001.bus
Location Dependency	Delta location from coordinate
Coordinate Reference	._BMWV5_rear_suspention.ground.hpl_integral_link_lower
Location	0,0,0
Location in	<input checked="" type="radio"/> local <input type="radio"/> global
Orientation Dependency	Orient axis along line
Coordinate Reference #1	._BMWV5_rear_suspention.ground.hpl_integral_link_lower
Coordinate Reference #2	._BMWV5_rear_suspention.ground.hpl_lca_rear_outer
Axis	<input checked="" type="radio"/> Z <input type="radio"/> X

At the bottom, there are three icons (a document, a graph, and a camera) and three buttons: OK, Apply, and Cancel.




点击 Apply。

#### 4.15.4 建立减振器下端的 Bush

修改上面的衬套对话框内容如下：

**Create Bushing Attachment**

Bushing Name	lwr_strut
I Part	._BMW5_rear_suspention.gel_lower_strut
J Part	._BMW5_rear_suspention.gel_lca
Type	<input checked="" type="radio"/> left <input type="radio"/> right <input type="radio"/> single
Inactive	<input type="radio"/> never <input checked="" type="radio"/> kinematic mode
Preload	0,0,0
Tpreload	0,0,0
Offset	0,0,0
Roffset	0,0,0
Geometry Length	20
Geometry Radius	30
Property File	mdids://acar_shared/bushings.tbl/mdi_0001.bus
Location Dependency	Delta location from coordinate
Coordinate Reference	._BMW5_rear_suspention.ground.hpl_damper_lwr
Location	0,0,0
Location in	<input checked="" type="radio"/> local <input type="radio"/> global
Orientation Dependency	Orient axis along line
Coordinate Reference #1	._BMW5_rear_suspention.ground.hpl_lca_rear_inner
Coordinate Reference #2	._BMW5_rear_suspention.ground.hpl_lca_front_inner
Axis	<input checked="" type="radio"/> Z <input type="radio"/> X





点击 Apply。

#### 4.15.5 建立减振器上端上 Top Mount

修改上面的衬套对话框内容如下：

**Create Bushing Attachment**

Bushing Name	top_mount
I Part	._BMW5_rear_suspention.gel_upper_strut
J Part	._BMW5_rear_suspention.mtl_rr_strut_to_body
Type	<input checked="" type="radio"/> left <input type="radio"/> right <input type="radio"/> single
Inactive	<input checked="" type="radio"/> never <input type="radio"/> kinematic mode
Preload	0,0,0
Tpreload	0,0,0
Offset	0,0,0
Roffset	0,0,0
Geometry Length	20
Geometry Radius	30
Property File	mdids://acar_shared/bushings.tbl/mdi_0001.bus
Location Dependency	Delta location from coordinate
Coordinate Reference	._BMW5_rear_suspention.ground.hpl_damper_upr
Location	0,0,0
Location in	<input checked="" type="radio"/> local <input type="radio"/> global
Orientation Dependency	User entered values
Orient using	<input checked="" type="radio"/> Euler Angles <input type="radio"/> Direction Vectors
Euler Angles	0,0,0
X Vector	1,0,0,0,0,0
Z Vector	0,0,0,0,1,0

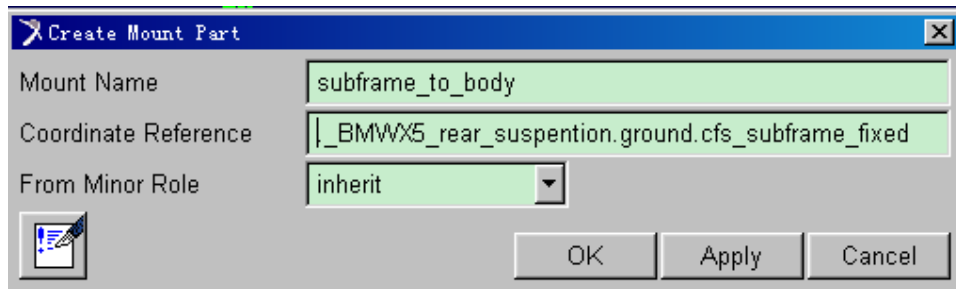
OK Apply Cancel

点击 Apply。

#### 4.15.6 创建后副车架到车身的衬套

1) 建立后副车架上代表车身的 Mount part (subframe\_to\_body)，从菜单选择 Build>Parts>Mount Part>New。





点击 OK。

2) 建立副车架连接到车身的左前衬套

从菜单选择 Build>Attachments>Bushing>New。在出现的对话框里输入以下内容：

Create Bushing Attachment	
Bushing Name	subframe_to_body_fit
I Part	._BMWx5_rear_suspention.ges_subframe
J Part	._BMWx5_rear_suspention.mts_subframe_to_body
Type	<input checked="" type="radio"/> left <input type="radio"/> right <input type="radio"/> single
Inactive	<input checked="" type="radio"/> never <input type="radio"/> kinematic mode
Preload	0,0,0
Tpreload	0,0,0
Offset	0,0,0
Roffset	0,0,0
Geometry Length	40
Geometry Radius	20
Property File	mdids://acar_shared/bushings.tbl/mdi_0001.bus
Location Dependency	Delta location from coordinate
Coordinate Reference	._BMWx5_rear_suspention.ground.hpl_subframe_to_body_fit
Location	0,0,0
Location in	<input checked="" type="radio"/> local <input type="radio"/> global
Orientation Dependency	User entered values
Orient using	<input checked="" type="radio"/> Euler Angles <input type="radio"/> Direction Vectors
Euler Angles	0,0,0
X Vector	1.0,0.0,0.0
Z Vector	0.0,0.0,1.0

点击 Apply。

- 3) 建立副车架连接到车身的左后衬套  
修改上面的对话框内容如下：

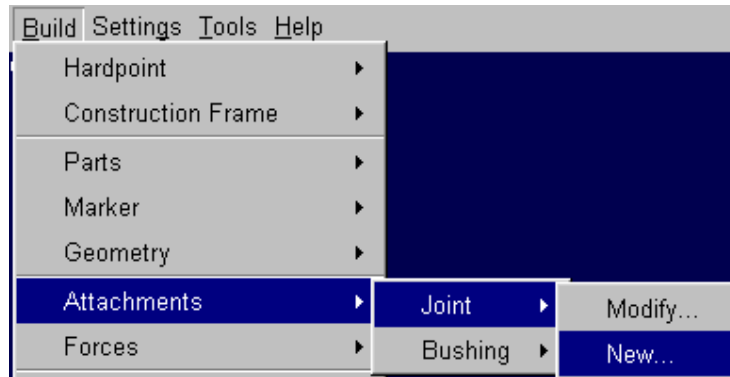
Create Bushing Attachment	
Bushing Name	subframe_to_body_rr
I Part	._BMW5_rear_suspension.ges_subframe
J Part	._BMW5_rear_suspension.mts_subframe_to_body
Type	<input checked="" type="radio"/> left <input type="radio"/> right <input type="radio"/> single
Inactive	<input checked="" type="radio"/> never <input type="radio"/> kinematic mode
Preload	0,0,0
Tpreload	0,0,0
Offset	0,0,0
Roffset	0,0,0
Geometry Length	50
Geometry Radius	30
Property File	mdids://acar_shared/bushings.tbl/mdi_0001.bus
Location Dependency	Delta location from coordinate
Coordinate Reference	._BMW5_rear_suspension.ground.hpl_subframe_to_body_rr
Location	0,0,0
Location in	<input checked="" type="radio"/> local <input type="radio"/> global
Orientation Dependency	User entered values
Orient using	<input checked="" type="radio"/> Euler Angles <input type="radio"/> Direction Vectors
Euler Angles	0,0,0
X Vector	1,0,0,0,0,0
Z Vector	0,0,0,0,1,0

点击 OK。

#### 4.16 创建部件间的刚性连接

1) 创建后副车架与车身的固定副

从下拉菜单选择 Build>Attachments>Joint>New。



在出现的对话框里输入以下内容:

**Create Joint Attachment**

Joint Name: subframe\_to\_body

I Part: .\_BMW5\_rear\_suspension.ges\_subframe

J Part: .\_BMW5\_rear\_suspension.mts\_subframe\_to\_body

Type: ☐ left ☐ right ☒ single

Joint Type: fixed

Active: ☒ always ☐ kinematic mode

Location Dependency: Delta location from coordinate

Coordinate Reference: .\_BMW5\_rear\_suspension.ground.cfs\_subframe\_fixed

Location: 0,0,0

Location in: ☒ local ☐ global

No Orientation Required

OK Apply Cancel






点击 Apply, 将后副车架固定到车身上。

2) 建立驱动轴和球笼 (Tripot) 之间的滑动副 (Translational Joint)

修改上面的对话框内容如下:

**Modify Joint Attachment**

Joint Name	tripot_to_differential
I Part	._BMWx5_rear_suspension.gel_tripot
J Part	._BMWx5_rear_suspension.mtl_driveshaft_to_diff
Type	<input checked="" type="radio"/> left <input type="radio"/> right <input type="radio"/> single
Joint Type	translational
Active	<input checked="" type="radio"/> always <input type="radio"/> kinematic mode
Location Dependency	Delta location from coordinate
Coordinate Reference	._BMWx5_rear_suspension.ground.hpl_driveshaft_inner
Location	0, 0, 0
Location in	<input checked="" type="radio"/> local <input type="radio"/> global
Orientation Dependency	Orient to zpoint-xpoint
Coordinate Reference #1	._BMWx5_rear_suspension.ground.hpr_driveshaft_inner
Coordinate Reference #2	._BMWx5_rear_suspension.ground.cfl_drive_shaft_otr
Axes	<input checked="" type="radio"/> ZX <input type="radio"/> XZ



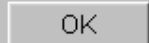
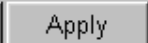
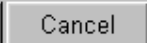






点击 Apply。

3) 创建驱动轴和球笼之间的等速万向节 (Convel Joint)

修改对话框内容如下:

Joint Name	driveshaft_inner
I Part	._BMWx5_rear_suspention.gel_driveshaft
J Part	._BMWx5_rear_suspention.gel_tripot
Type	<input checked="" type="radio"/> left <input type="radio"/> right <input type="radio"/> single
Joint Type	convel
Active	<input checked="" type="radio"/> always <input type="radio"/> kinematic mode
Location Dependency	Delta location from coordinate
Coordinate Reference	._BMWx5_rear_suspention.ground.hpl_driveshaft_inner
Location	0, 0, 0
Location in	<input checked="" type="radio"/> local <input type="radio"/> global
I-Part Axis	._BMWx5_rear_suspention.ground.hpr_driveshaft_inner
J-Part Axis	._BMWx5_rear_suspention.ground.cfl_drive_shaft_otr

点击 Apply。

4) 创建驱动轴和轮毂之间的等速万向节 (Convel Joint)

修改上面的对话框内容如下：

**Create Joint Attachment**

Joint Name:

I Part:

J Part:

Type: ☒ left ☐ right ☐ single

Joint Type:

Active: ☒ always ☐ kinematic mode

Location Dependency:



Coordinate Reference:

Location:

Location in: ☒ local ☐ global

I-Part Axis:

J-Part Axis:

OK Apply Cancel

点击 Apply。

5) 建立轮毂和转向节间的旋转副

修改上面的对话框内容如下：

**Create Joint Attachment**

Joint Name:

I Part:

J Part:

Type: ☒ left ☐ right ☐ single

Joint Type:

Active: ☒ always ☐ kinematic mode

Location Dependency:

Coordinate Reference:

Location:



Location in: ☒ local ☐ global

Orientation Dependency:

Coordinate Reference #1:

Coordinate Reference #2:

Axis: ☒ Z ☐ X

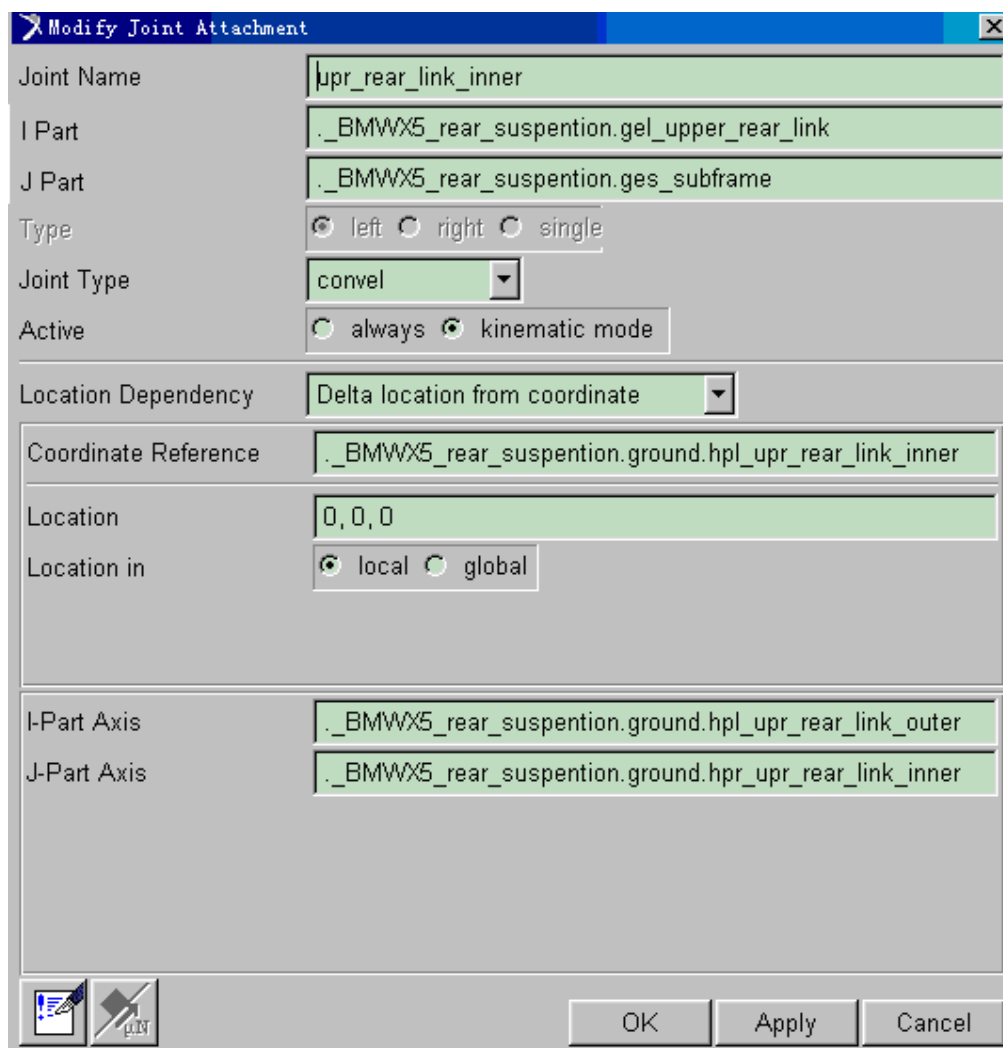
 

点击 Apply。

6) 建立上后控制臂和车身间的等速万向节

修改上面的对话框内容如下：

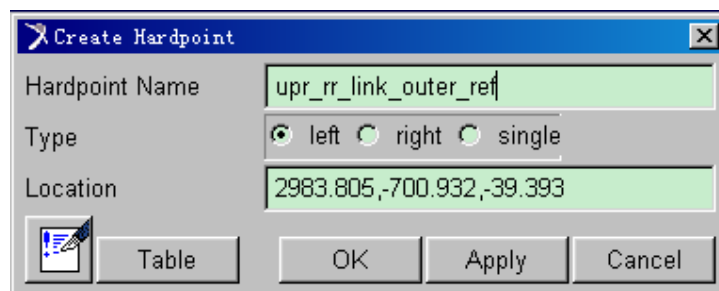




点击 Apply。

7) 创建上后控制臂与转向节间的球铰

建立上后控制臂外球铰参考点:



修改上面的约束副对话框内容如下:

**Create Joint Attachment**

Joint Name:

I Part:

J Part:

Type: ☒ left ☐ right ☐ single

Joint Type:

Active: ☒ always ☐ kinematic mode

Location Dependency:

Coordinate Reference:




Location:

Location in: ☒ local ☐ global

Orientation:

I-Part Axis:

J-Part Axis:

点击 Apply。

8) 创建上前控制臂与转向节间的球铰


建立上前控制臂外点参考点:

**Create Hardpoint**

Hardpoint Name:

Type: ☒ left ☐ right ☐ single

Location:



修改上面的约束副对话框内容:

**Create Joint Attachment**

Joint Name:

I Part:

J Part:

Type: ☒ left ☐ right ☐ single

Joint Type:

Active: ☒ always ☐ kinematic mode

Location Dependency:

Coordinate Reference:



Location:

Location in: ☒ local ☐ global

Orientation:

I-Part Axis:

J-Part Axis:

点击 Apply。

9) 建立下控制臂与转向节间的球铰

修改上面的运动副对话框内容如下：

**Create Joint Attachment**

Joint Name: lca\_balljoint

I Part: .\_BMWV5\_rear\_suspention.gel\_lca

J Part: .\_BMWV5\_rear\_suspention.gel\_kunckle\_rr

Type: ☒ left ☐ right ☐ single

Joint Type: spherical

Active: ☒ always ☐ kinematic mode

Location Dependency: Delta location from coordinate

Coordinate Reference: .\_BMWV5\_rear\_suspention.ground.hpl\_lca\_rear\_outer

Location: 0,0,0

Location in: ☒ local ☐ global

Orientation: Using Two Axes

I-Part Axis: .\_BMWV5\_rear\_suspention.ground.hpl\_integral\_link\_lower

J-Part Axis: .\_BMWV5\_rear\_suspention.ground.hpl\_kunckle\_center

OK Apply Cancel



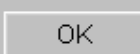
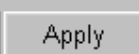
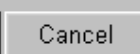
点击 Apply。

10) 创建减振器下端与下控制臂间的虎克铰

修改上面的运动副对话框内容如下：

**Modify Joint Attachment**

Joint Name	strut_kinematic
I Part	._BMWx5_rear_suspension.gel_lower_strut
J Part	._BMWx5_rear_suspension.gel_lca
Type	<input checked="" type="radio"/> left <input type="radio"/> right <input type="radio"/> single
Joint Type	hooke
Active	<input type="radio"/> always <input checked="" type="radio"/> kinematic mode
Location Dependency	Delta location from coordinate
Coordinate Reference	._BMWx5_rear_suspension.ground.hpl_damper_lwr
Location	0, 0, 0
Location in	<input checked="" type="radio"/> local <input type="radio"/> global
I-Part Axis	._BMWx5_rear_suspension.ground.hpl_damper_upr
J-Part Axis	._BMWx5_rear_suspension.ground.cfl_lwr_strut_ext


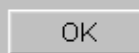
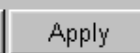
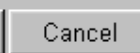






点击 Apply。

- 11) 创建减振器上端和车身间的虎克铰  
建立减振器和车身连接的 Mount

**Create Mount Part**



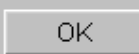
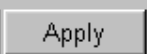
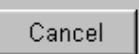
Mount Name	rr_strut_to_body
Coordinate Reference	._BMWx5_rear_suspension.ground.hpl_damper_upr
From Minor Role	inherit

修改上面的运动副对话框内容如下：

**Create Joint Attachment**

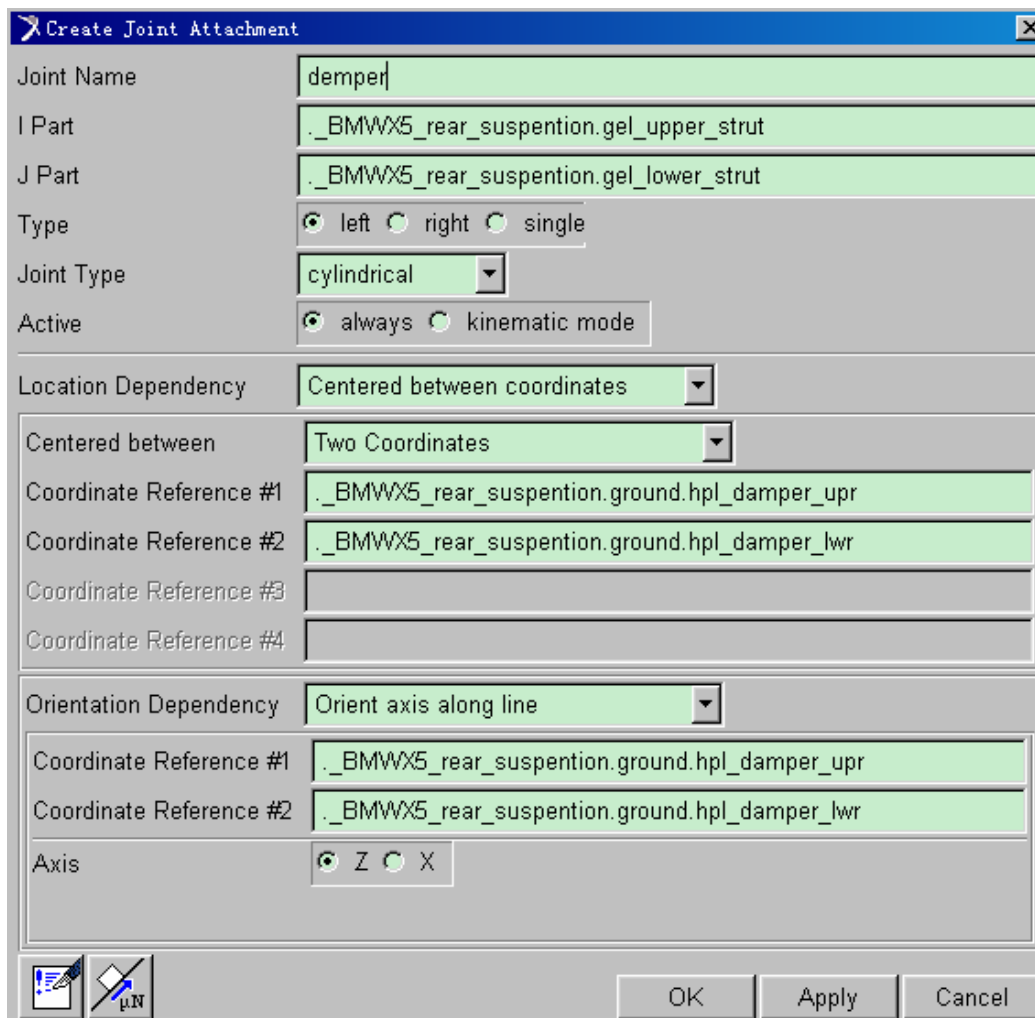
Joint Name	top_mount_kinematic
I Part	._BMW5_rear_suspension.gel_upper_strut
J Part	._BMW5_rear_suspension.mtl_rr_strut_to_body
Type	<input checked="" type="radio"/> left <input type="radio"/> right <input type="radio"/> single
Joint Type	hooke
Active	<input type="radio"/> always <input checked="" type="radio"/> kinematic mode
Location Dependency	Delta location from coordinate
Coordinate Reference	._BMW5_rear_suspension.ground.hpl_damper_upr
Location	0,0,0
Location in	<input checked="" type="radio"/> local <input type="radio"/> global
I-Part Axis	._BMW5_rear_suspension.ground.hpl_damper_lwr
J-Part Axis	._BMW5_rear_suspension.ground.cfl_top_mount_ext

点击 Apply。

11) 建立减振器上下滑动的滑动副

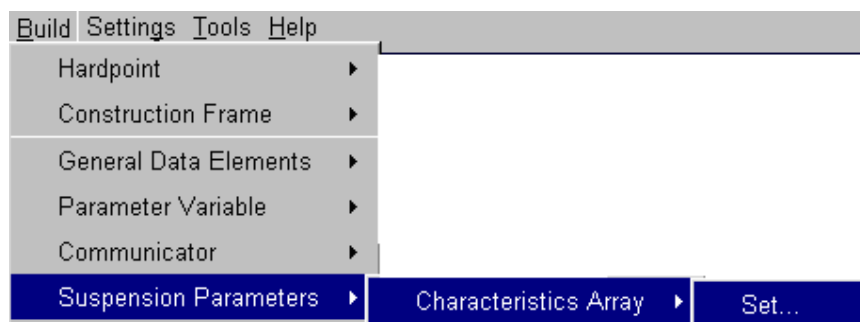
修改上面的运动副对话框内容如下：



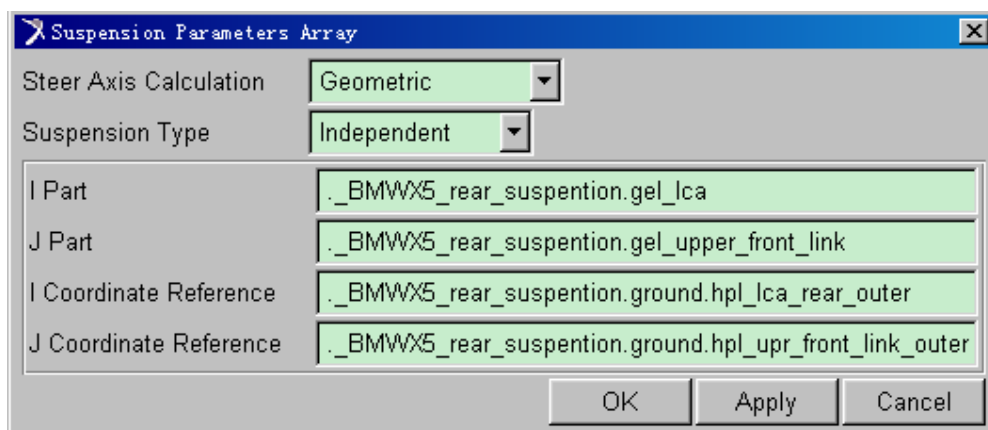
点击 OK。

#### 4.17 设定悬架参数

从菜单选择 Build>Suspension Parameters>Characteristics Array>Set

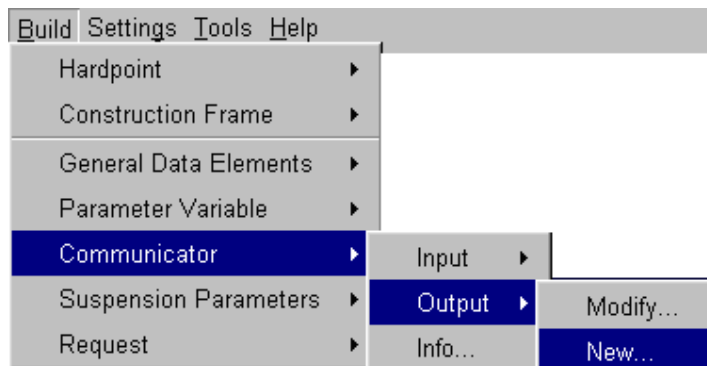


在出现的对话框里输入如下内容：

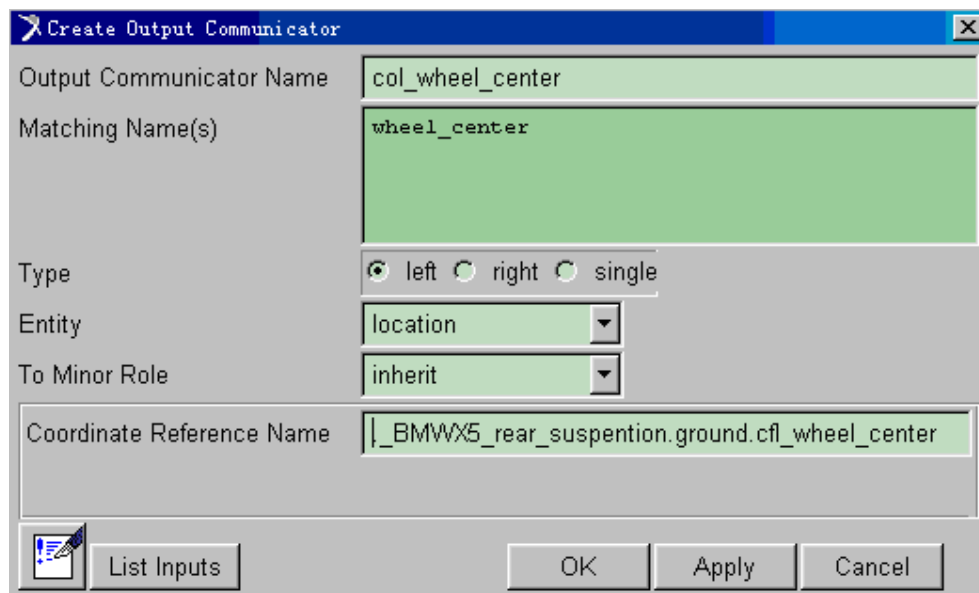


#### 4.18 创建必要的输出通讯器

从菜单选择 Build>Communicator>Output>New。

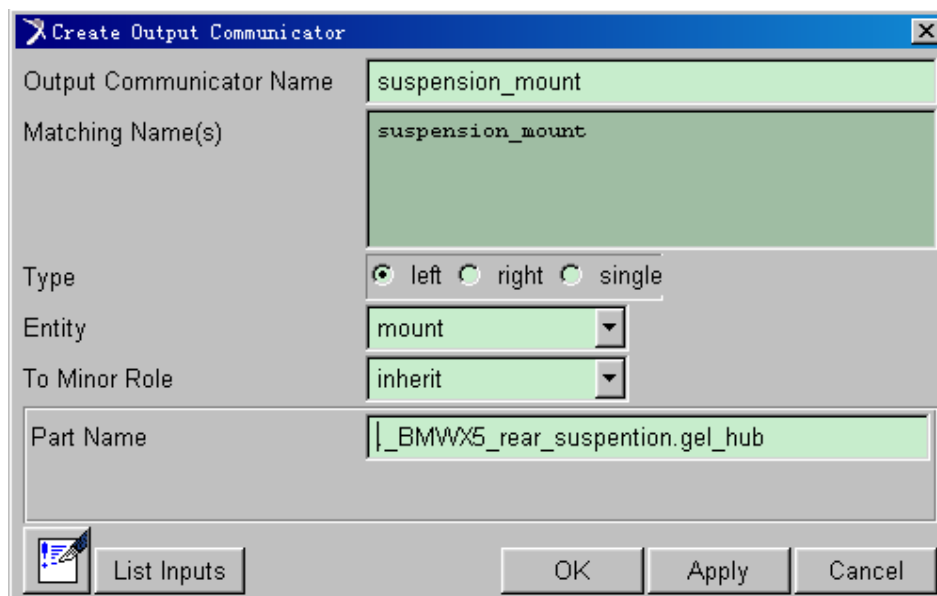


在出现的对话框里输入以下内容：



点击 Apply，修改上面的对话框内容如下：

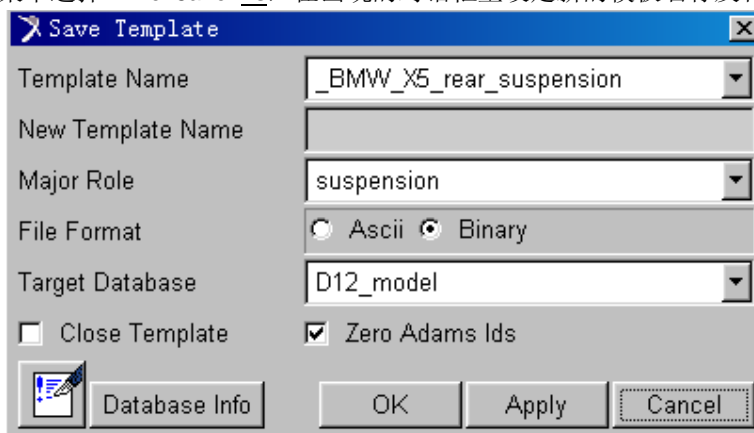




点击 OK。

#### 4.19 保存模型

从下拉菜单选择 File>Save As, 在出现的对话框里设定新的模板名称及目标数据库。



点击 OK 完成模板文件保存。